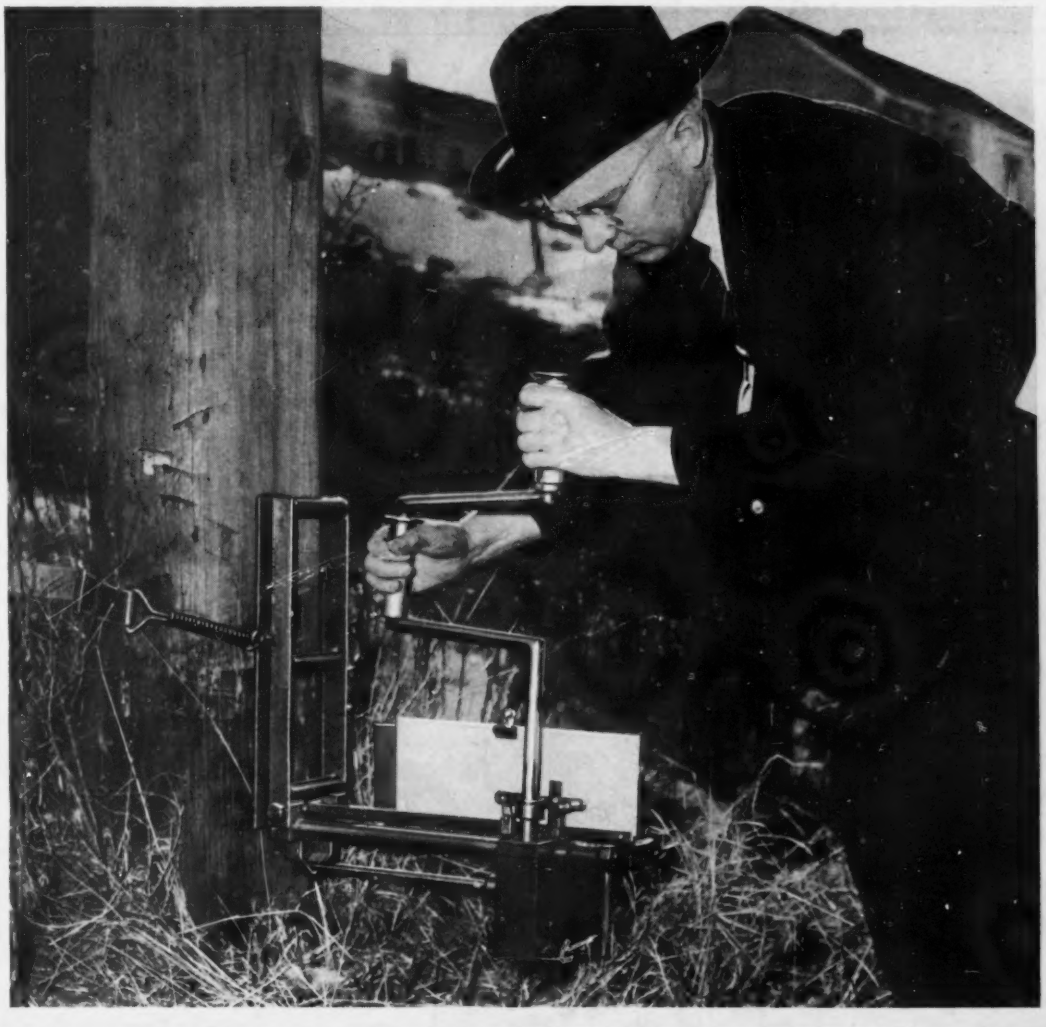
Electrical World

JUL 8 1946



JULY 6, 1946

Digest of AIEE Convention Papers and Discussions

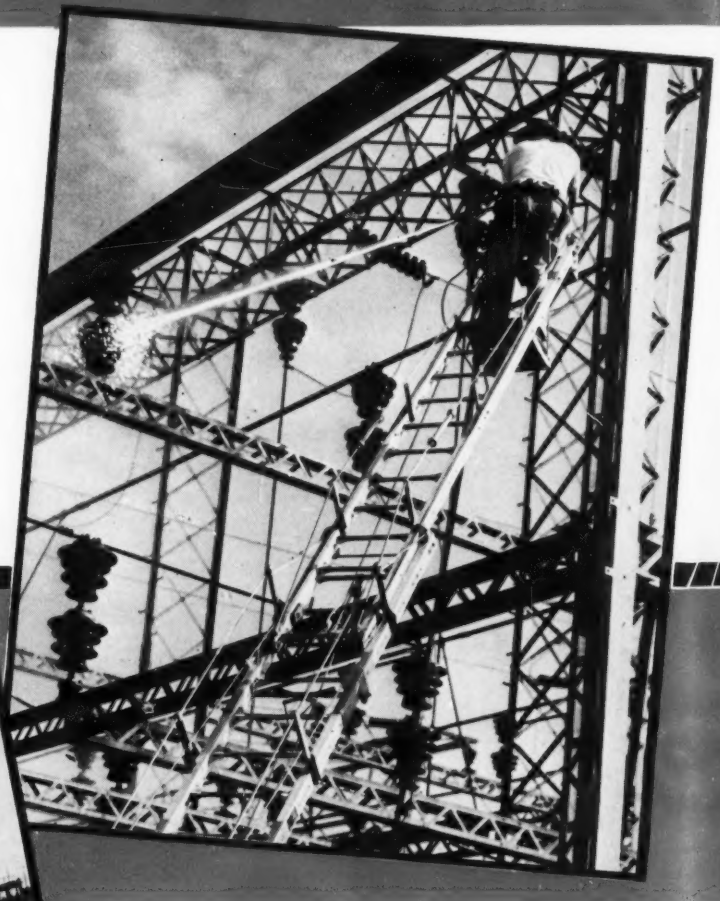
Measurement of Insulation Resistance • Rural Load Economics

Torque Tester Graphs Pole Conditions • Substation Span Sag Calculations

A McGRAW-HILL PUBLICATION

CONTROL
CURRENT LEAKAGE
LINE DISTURBANCE
FLASH-OVER *this easy way!*

Nearly every utility has
Crows'nests
every utility needs them!



NEW USES FOR THIS ACKNOWLEDGED STANDARD OF THE ELECTRICAL INDUSTRY

Add to the uses for Crows'nests the cleaning of insulators on high-tension lines and outdoor sub-stations. The importance of clean insulators is recognized by operating engineers, for dirty insulators mean current leakage and flash-overs and can result in serious line interruptions. We build Crows'nests to reach as high as 50 feet—the one illustrated is 32-foot model. Let us know what size Crows'nest you will need.

To make line and sub-station insulator cleaning a cheaper, quicker, better job, just fill in required data on the coupon or write us. No obligation. Metropolitan Device Corporation, 1250 Atlantic Avenue, Brooklyn 16, N. Y.

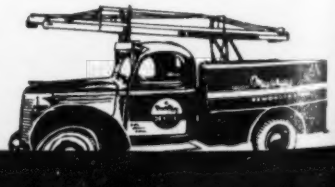
ROPOLITAN DEVICE CORPORATION
) Atlantic Avenue, Brooklyn 16, New York

l data on Crows'nest providing maximum working
ht of_____feet above ground.

AE TITLE

APANY

Murray
DEMOUNTABLE
Crows'nest



Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 72 YEARS

July 6, 1946 — Vol. 126, No. 1

Contents

City Rates Help Build Rural Loads 60
E. C. HATHAWAY, Central Vermont Public Service Corp.

Strain Insulator Effect in Substation Span Sags 62
J. R. STOVER, New York State Electric & Gas Corp.

Measuring D. C. Insulation Resistance and Capacitance 64
LOREN H. HUTCHINS, JR., Simplex Wire & Cable Co.

Southwark Station Aimed to be Simple and Reliable II 66
L. R. GATY and E. B. SHEW, Philadelphia Electric Co.

Torque Screw Pole Tester Graphs Condition of Standing Poles 69
HOWARD A. STINGLE, Washington Water Power Co.

Engineers Confer at Detroit on Diversified Current Issue 70

Digests 76

Editorials ..... 59 and 80

Washington Comment 82

News of the Week 83

HOW 91

Engineering Reference Sheets ..... 98, 100 and 102

Load Building 116

New Equipment 126

Catalogs and Bulletins 135

News About People 143

Manufacturers and Markets 152

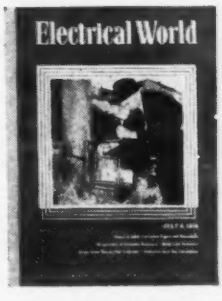
Sales Opportunities 158

Recent Rate Changes 160

Rural Allotments 161

Book Reviews 163

Index of Advertisements 170



THE COVER—As crank is turned, resistance to driven probe registers on graph shown to indicate amount and location of pole rot. See page 69.

SAMUEL B. WILLIAMS.....*Editor*

DANIEL T. BRAYMER....*Managing Editor*
ARCHER E. KNOWLTON..*Associate Editor*
FRANK R. INNES.....*Associate Editor*
RUE M. SHOOP.....*Assistant Editor*
JULIUS C. MEIER...*Manufacturing Editor*
KENNETH K. KOST.....*News Editor*
EDNA M. GLENNON.*Assistant News Editor*
FRANK E. SANFORD.....*Western Editor*
HOWARD S. KNOWLTON
New England Editor
WALTER C. HESTON..*Pacific Coast Editor*
RICHARD N. LARKIN
Washington Correspondent
DONALD D. HOCATE
Manager, Washington Bureau
DEXTER KEEZER
Director, Economics Department

M. S. MacNAUGHT.....*Manager*

DISTRICT MANAGERS
E. F. COFFEY.....*New York*
N. V. PALMER.....*Boston*
F. P. COYLE.....*Philadelphia*
C. R. LIPPOLD.....*Cleveland*
S. H. BABCOCK.....*Detroit*
W. H. MENEILLEY.....*Chicago*
J. T. SCHAEFER.....*St. Louis*

LEE H. HILL.....*Publisher*

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owners.

ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to J. E. Blackburn, Jr., Director of Circulation.

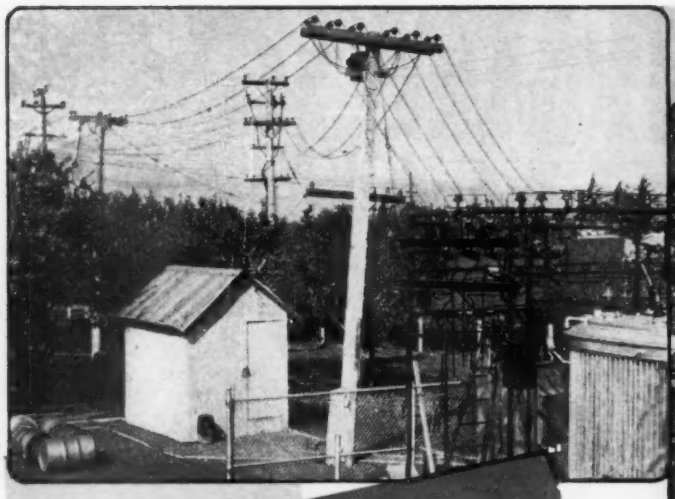
RETURN POSTAGE GUARANTEED

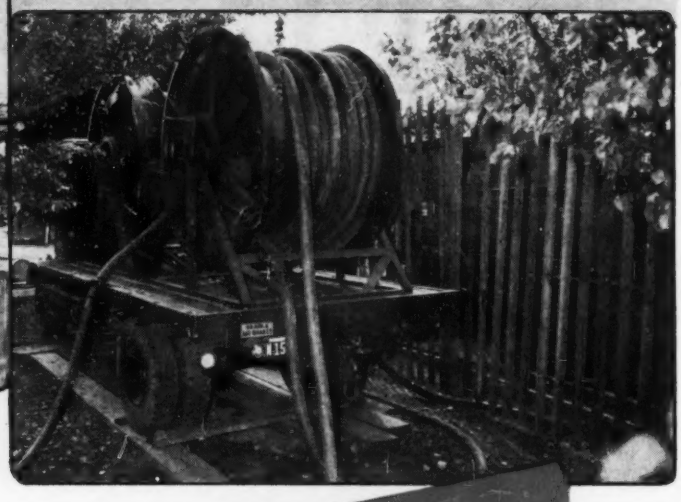
Subscription rates: In the United States, $5 a year, $8 for two years, $10 for three years. Canada $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Pan-American countries $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879.
Printed in the U.S.A. Contents copyrighted, 1946, by McGraw-Hill Publishing Company, Inc. All Rights Reserved.
Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W.C.2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office .....99-129 N. Broadway, Albany 1, N. Y.
Editorial and Executive Offices....330 West 42nd St., New York 18, N. Y.
JAMES H. McGRAW, JR.....President
CURTIS W. McGRAW.....Senior Vice-President and Treasurer
JOSEPH A. GERARDI.....Secretary
NELSON BOND.....Director of Advertising
EUGENE DUFFIELD.....Editorial Assistant to the President
J. E. BLACKBURN, JR.....Director of Circulation

Member A.B.P. Member A.B.C.
Cable Address McGRAW-HILL, New York





MOBILE SUBSTATION PROBLEM SOLVED

by OKONITE-ENGINEERED CABLES

"Greatly added to the versatility and usefulness of the substation" . . . "Cutting-in can be done in a matter of minutes instead of sometimes hours" . . . these are two of the results reported upon in a recent article in "Electrical West" telling how Pacific Gas and Electric Company solved a specific substation problem by the use of Okonite's high voltage portable cable for the emergency power leads.

Full details available

A 4-page illustrated reprint of this article in its entirety has been prepared. It affords a detailed case history which should be of interest to electrical engineers in public utilities or other branches of industry who must consider having emergency power facilities always available. Send for Bulletin OK-2057. The Okonite Company, Passaic, N. J.

4592

OKONITE SINCE 1878 **insulated wires and cables**

Electrical World

JULY 6, 1946

Productivity

ALTHOUGH they have their fingers crossed when they say it, and as a rule refuse to be quoted, management people in electrical manufacturing companies that have had strikes admit a decided improvement in the productivity of the workers when they have an adequate supply of materials with which to work. Apparently this same condition holds for other industries that have had long drawn-out shut-downs, because steel and automobiles are said to be experiencing amazing productivity improvements, in some instances approaching pre-war performance.

One might speculate on the reason for this reversal of trend and come up with one or more reasonable answers, but the fact remains that labor generally can never enjoy the full benefits of wage increases if the manufacturers have to pass them right along, and in their entirety, to the user.

During the several strikes earlier this year in heavy industry labor contended that producers could well afford to pay the increases asked without resorting to higher prices. Were productivity to increase, as is reported to be the case with one large automobile company, from two-thirds of pre-war to pre-war level then management would be less inclined to seek the higher prices now deemed necessary to offset wage increases. If labor is deliberately setting out to justify its earlier contention it can choose no better way than the "proof of the pudding" route.

In fact, we believe American industry would be glad to grant wage increases in return for improved productivity. That has been the history of industrial progress in this country. What other nation has so fine a record for industrial production or for wages of workers? Is that not the basis of the high standard of living in this country?

In the past, however, improved productivity has come almost always out of mechanization rather than from greater exertion on the part of the worker. In fact, as a rule the new machine enabled him to turn out more than before with even less effort and skill on his part.

So far manufacturers have been hesitant to admit for the record that the productivity has been greatly improved, and when they have talked it has been in very general terms. Of course, one can understand that it is not only difficult to compare performance now with that at some earlier date, or even to arrive at any conclusive data as of today because of the variable and inadequate materials supply. There is another reason for reticence, however, that is of greater significance. Before admitting the existence of an improvement, industry wants to be sure that this is no flash in the pan, but is a permanent reversal.

If labor could find some way of convincing industry that productivity would not only return to pre-war levels, but even improve, then OPA decontrol could be effected with very little worry about contributing greatly to inflation.

Experience in previous long strikes has been that workers, being glad to be back on the job, have as a rule started out with improved productivity but lapses set in as time softened the memory of the strike. Is the current situation merely one of history repeating itself, or is labor seriously trying to earn its increase?

Within these two groups of labor and management lies the ability in large measure to head off any large scale inflation. The one wants a better real wage, and the other wants lower unit costs of production. The two are not necessarily incompatible.

CITY RATES
Help Build Rural Loads*

E. C. HATHAWAY, *Commercial Manager, Central Vermont Public Service Corp., Rutland*

Central Vermont's minimum charge on extensions is $2 per month without construction cost guarantees—25-cow dairy farm's average use is 4,800 kw.-hr. per year—Farm line revenue, $240 per mile

SINCE 1906 the proportion in rural areas of Central Vermont Public Service's total distribution line mileage has risen from 12 to 85 percent; over 2,100 miles of the company's lines are now serving farming areas with a customer density of about four per mile. Rates have been reduced most substantially.

The company serves a very fertile area on both sides of the Green Mountain Range with a total population of about 170,000. Dairying has been the backbone of Vermont agriculture for over 75 years, and these farms do an annual business of about $45,000,000. Such farms are a real market for the sale of electricity and experience has shown that cows as well as human beings are good customers. On the basis of the national average consumption per residential customer of about 1,200 kw.-hr. per year and assuming four people in the average family, the average consumption per person is 300 kw.-hr. per year or 25 kw.-hr. per month. Studies of the potential market on a Vermont dairy farm producing milk for the Boston and New York markets show that a dairy cow is good for an average monthly use of 16 kw.-hr.

This 16 kw.-hr. per month per cow is arrived at by listing the various devices and equipment that a typical electrified farm milking 25 cows uses now. This farm requires a milking machine, milk cooler, pump for water supply, a dairy water heater in the milk house, a chore motor and lights for the barns, sheds, etc. These various uses on a 25-cow farm total 4,800 kw.-hr. per year or 400 kw.-hr. per month. That's 16 kw.-hr. per cow per month. Add to this the household use of 1,200 kw.-hr. which is approximately the national average household use and this 25-cow farm is a potential customer for 6,000 kw.-hr. At present V.P.S. rates the annual cost of electricity would be $152, which results in an average rate of 2.5 cents per kilowatt-hour.

At the average rate, a milch cow means 40 cents a month revenue from the sale of electricity, or $4.80 per annum. So we have come to respect the dairy cow as a consumer of electricity!

The development of the various labor-saving devices for farm use in the last ten years is causing utility operators to become more optimistic towards expansion into rural territory. Since 1937 the V.P.S. average annual use per farm customer has grown from 1,250 kw.-hr. to 2,287 kw.-hr., an increase of 82 percent. The average rate paid by farm customers has dropped from 4.46 cents to 3.23 cents, a decrease of 27 percent. This has been brought about by the happy combination of reductions in rates, monthly guarantees or minimum charges on our part, and the increased use by our good farm customers.

Replacing Hired Men

Many a farmer has learned during recent years that $12 to $15 worth of electricity monthly will replace a hired man that costs him a lot more than that much weekly.

During 1945 our farm customers paid us an average annual bill of $73.95 for the electricity consumed. In the first three months of this year the average use per farm has increased 48 kw.-hr. By 1947 we expect that the average farm use will reach or exceed 2,500 kw.-hr. Our sights are set for 6,000 kw.-hr. per farm per year, largely because we supply many dairy farms.

We supply our rural farm customers at the same rates that apply in the cities and villages we serve. The first 20 kw.-hr. are billed at 8 cents each; the next 30 kw.-hr. at 5 cents; the next 60 at 3 cents, and all over 110 are billed at 2 cents. The minimum charge on rural line extensions is $2.00 per month. No long-term contract is required. Ordinarily we expect a minimum of three customers to the mile, but where it is warranted we take on business at lower densities. We are planning to serve our whole territory on an area basis so as to electrify completely all the rural territory which is our responsibility to serve. Some of it is lean, but over-all we have solicited 3,600 customers who can be served from 1,000 miles of new line. This gives an average ultimate density of 3.6 customers per mile. Nearly 200 miles of this has been completed and we have plans to construct 800 miles of line this year which will almost completely cover the towns we serve. We expect there may be a few isolated places that no one can serve economically. Barring delays in the receipt of materials and given an even break on weather, we think we can live up to this program. When we get this job done, nearly 90 percent of our distribution pole line mileage will be in rural lines.

Seek Self-Supporting Lines

This means we have a sizable selling job ahead of us to get our rural and farm customers to purchase and install labor-saving devices, equipment and appliances which will consume

* *From a paper before the 7th New England Rural Electrification Institute at Amherst, Mass., April 17, 1946.*

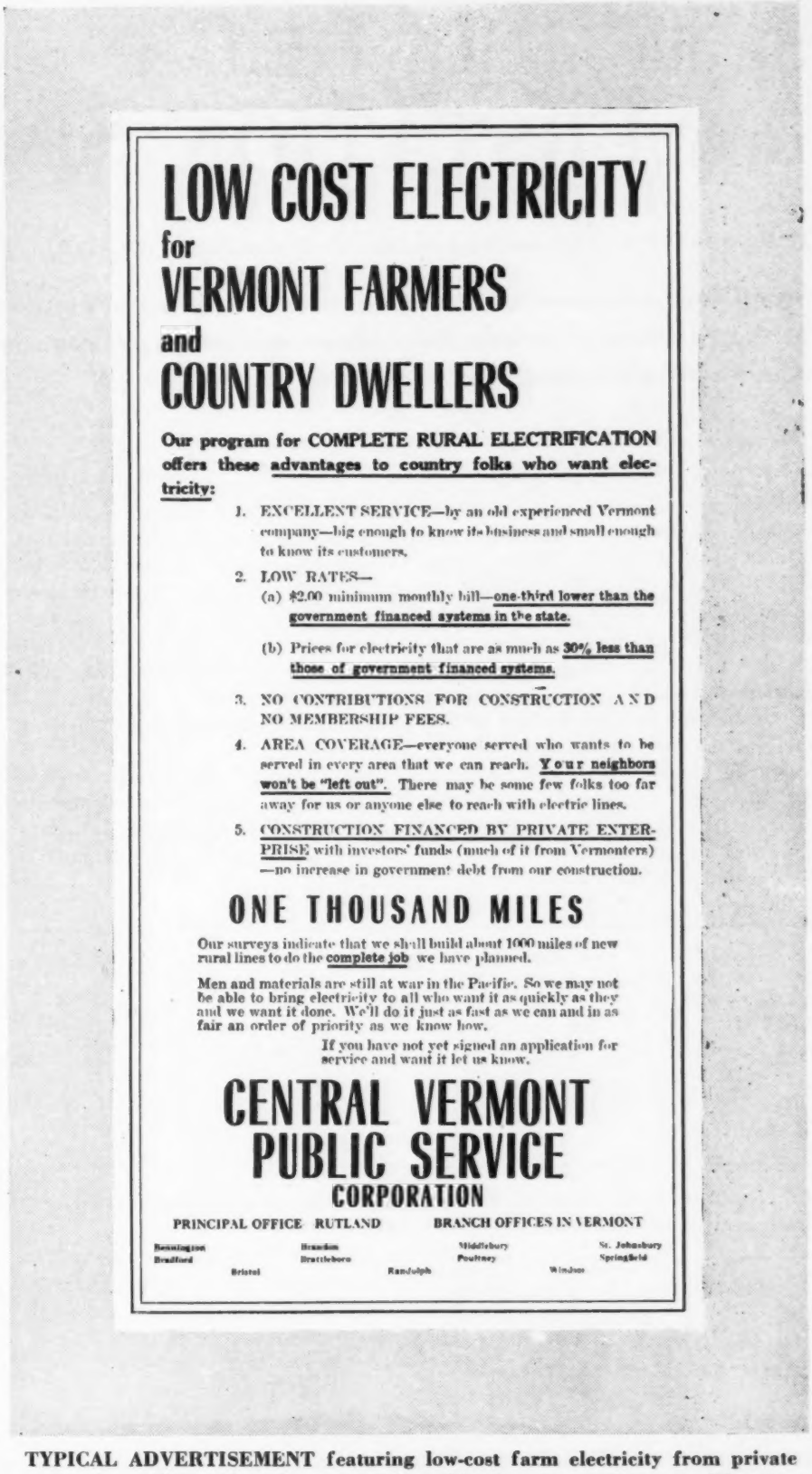
electricity in sufficient volume so that these rural lines will support themselves and not burden the urban consumers. Experience in recent years leads me to believe that we can accomplish this.

The first step we have taken to build up farm use has been to create a small department of farm advisers or experts, consisting of four men whose educational training and experience are agricultural, supervised by Ralph Bugbee, who has been doing that kind of work for us for eleven years. Their job is to show our farm customers how the farm net income can be increased by the intelligent application of electricity. That's why these words appear on the back of the motor vehicle which Mr. Bugbee drives: "Electrify the Farm—For Profit." Once the farmers kidded him that this message referred to our profit only, but now almost all of them realize it refers to the profit from farm operations. The scarcity of labor during the war years and even now has brought about a far greater appreciation of the value of electricity in farmers' minds.

Revenues per Mile

Last year revenues from farms and rural dwellers served from our rural lines averaged $240 per mile. It is difficult to determine exactly the operating and maintenance expenses per mile of line but if we apply unit costs for one operating district which serves practically all rural business we ought to get close to the real costs. By doing so we arrive at a figure of about $170 per mile. Thus $240 revenue covers the expenses and provides $70 to take care of reserve for replacement and return on the investment. Besides the farm and rural residential business, which is classified separately and hence easy to identify, there are also some commercial accounts, such as an occasional store, garage, milk processing plant, quarry and saw-mill. All these help to improve the rural line load.

With increasing costs we must raise our sights to the point of securing an average annual revenue of $300 per mile to earn a better return on investments in such lines. Increasing costs of materials and increasing operating expenses may compel us to raise our sights even higher. I think our industry has a sizable task to create a market for electricity where it has invested substantial sums in rural distribution lines. The market among productive farms such as we serve can be developed and we shall do our utmost to make the greater use of electricity profitable to the farm consumer, for in doing so we expect to provide ourselves with a profitable and lasting market.


LOW COST ELECTRICITY
for
VERMONT FARMERS
and
COUNTRY DWELLERS
Our program for COMPLETE RURAL ELECTRIFICATION offers these advantages to country folks who want electricity:
1. EXCELLENT SERVICE—by an old experienced Vermont company—big enough to know its business and small enough to know its customers.
2. LOW RATES—
(a) $2.00 minimum monthly bill—one-third lower than the government financed systems in the state.
(b) Prices for electricity that are as much as 30% less than those of government financed systems.
3. NO CONTRIBUTIONS FOR CONSTRUCTION AND NO MEMBERSHIP FEES.
4. AREA COVERAGE—everyone served who wants to be served in every area that we can reach. Your neighbors won't be "left out". There may be some few folks too far away for us or anyone else to reach with electric lines.
5. CONSTRUCTION FINANCED BY PRIVATE ENTERPRISE with investors' funds (much of it from Vermonters) —no increase in government debt from our construction.
ONE THOUSAND MILES
Our surveys indicate that we shall build about 1000 miles of new rural lines to do the complete job we have planned.
Men and materials are still at war in the Pacific. So we may not be able to bring electricity to all who want it as quickly as they and we want it done. We'll do it just as fast as we can and in as fair an order of priority as we know how.
If you have not yet signed an application for service and want it let us know.
CENTRAL VERMONT PUBLIC SERVICE CORPORATION
PRINCIPAL OFFICE RUTLAND
BRANCH OFFICES IN VERMONT
Bennington
Bradford
Brandon
Brattleboro
Middlebury
Poultney
St. Johnsbury
Springfield
Bristol
Randolph
Windsor

TYPICAL ADVERTISEMENT featuring low-cost farm electricity from private enterprise utility and early construction objectives in rural areas—Advertisement voices determination to serve all possible country consumers as fast as materials become available—1,000 miles of new lines planned

Strain Insulator Effect in SUBSTATION SPAN SAGS

J. R. STOVER, *Electrical Engineer, New York State Electric & Gas Corp., Binghamton*

Small sags are desirable in substation bus spans—Calculation of the resultant tensions fixes structural strength requirements—

A method of handling the composite catenaries

IN THE CALCULATION of sags and tensions for short-span high-voltage substation buses the effect of the strain insulators must be considered along with the conductor. The shorter the span the more effect the insulators have on the calculation, since the length of the insulator string becomes a greater percentage of the total span length and the weight per foot of insulators is many times that of the conductor or cable. It is assumed that the string of insulators will be the same length and weight at both ends of the span; so only one-half of the span is considered in the calculation.

If a cable hangs still in space between two fixed supports it will form a catenary curve under all conditions of sags and tensions. The string of insulators forms a catenary curve which is different from the catenary curve formed by the conductor. These two curves are tangent at the point of connection marked (S) in Fig. 1 and have the same horizontal tension at all points.

The tangent of the circular angle is equal to the sine of the hyperbolic angle; therefore, the hyperbolic angle of both of the curves must be equal at point (S).

Basic Catenary Formulas

$$Y = a \cosh \frac{X}{a}$$

$$\tan \phi = \sinh \frac{X}{a}$$

$$C = 2a \sinh \frac{X}{a} = \text{length of arc}$$

$$D = Y - a$$

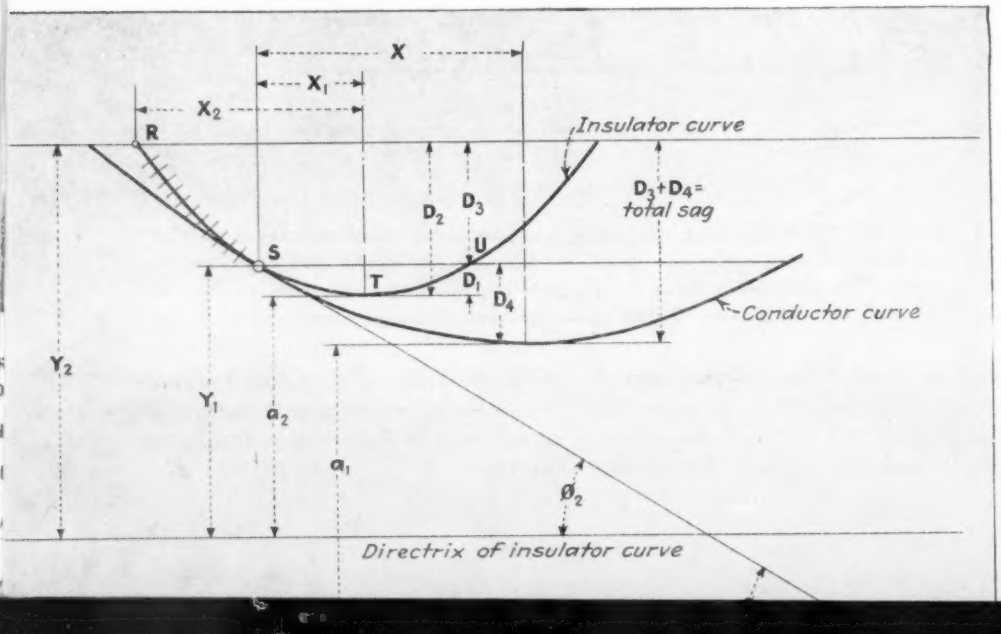
$$H = a\,W$$

H = Horizontal tension in lb.

W = Weight per foot

a = Distance from lowest point of curve to directrix.

FIG. 1—Geometry of composite catenary comprising string of insulators (relatively heavy) and conductor (relatively light)



Calculation (Fig. 1)

$$a_2 = \frac{H}{W_1} \text{ for insulator curve}$$

$$a_1 = \frac{H}{W_c} \text{ for conductor curve}$$

$$\tan \phi_2 = \tan \phi_1$$

$$\tan \phi_2 = \sinh \frac{X_1}{a_2}$$

$$\tan \phi_1 = \sinh \frac{X}{a_1}$$

$$\sinh \frac{X_1}{a_2} = \sinh \frac{X}{a_1}$$ for curves having same Y_1 axis originating at point (S).

$$\text{Then } \frac{X_1}{a_2} = \frac{X}{a_1} \text{ or } X_1 = \frac{a_2 X}{a_1}$$

X is obtained by subtracting the length of one insulator string from half the total span length.

$$Y_1 = a_2 \cosh \frac{X_1}{a_2}$$

$$D_1 = Y_1 - a_2$$

Now determine length of arc "ST" in Fig. 1.

$$\text{ST} = \frac{1}{2}\,\text{STU}$$

$$\text{STU} = 2a_2 \sinh \frac{X_1}{a_2}$$

$$\text{ST} = a_2 \sinh \frac{X_1}{a_2}$$

The length of the arc "RS" is the measured length of the insulator string.

Then arc ST + RS = RST

$$\text{RST} = a_2 \sinh \frac{X_2}{a_2}$$

$$\frac{X_2}{a_2} = \sinh^{-1} \frac{\text{RST}}{a_2}$$

$$X_2 = a_2 \sinh^{-1} \frac{\text{RST}}{a_2}$$

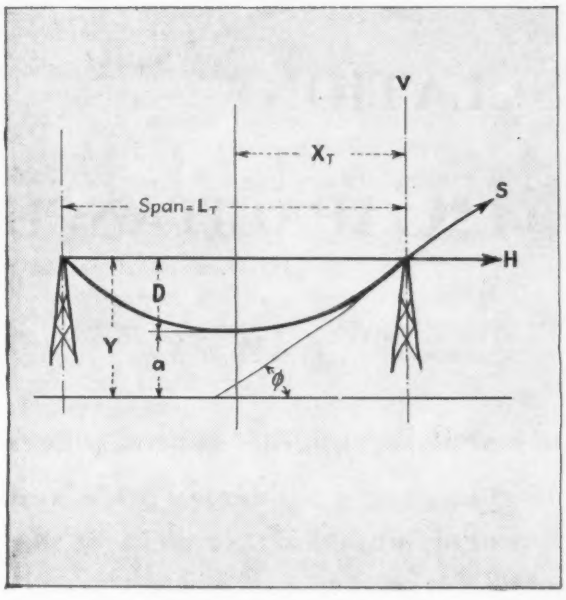
$$\text{Then } Y_2 = a_2 \cosh \frac{X_2}{a_2}$$

$$\text{and } D_2 = Y_2 - a_2$$

The sag of the insulators is

$$D_3 = D_2 - D_1$$

The wire sag is calculated in the normal manner using the same horizontal tension used for the insulator sag.



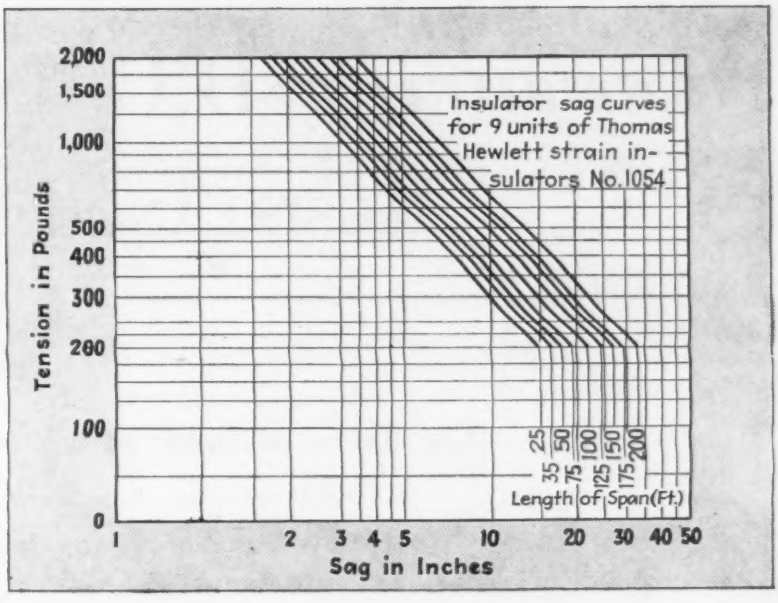


FIG. 2—Sag and tension curves for string of nine Thomas-Hewlett insulators for spans 25 to 200 ft.

EXAMPLE OF INSULATOR SAG CALCULATION

Assume—stringing tension H at 0 deg. F. = 1,540 lb. (calculated in normal manner)

Length of 9 unit Thomas Hewlett insulator string (RS) = 4.375 ft.

Length of two insulator strings = 8.75 ft.

Length of wire span (L) = 91.25 ft.

Weight of insulator string (W) = 26 lb. per ft.

Weight of wire (W_2) = 0.652 lb. per ft.

$$a = \frac{H}{W}$$

$$a_1 = \frac{H}{W_2} = \frac{1540}{0.652} = 2361.963 \text{ for wire}$$

$$a_2 = \frac{H}{W_1} = \frac{1540}{26} = 59.23 \text{ for insulators}$$

$$X = \tfrac{1}{2} L = \frac{91.25}{2} = 45.625$$

$$X_1 = \frac{a_2 X}{a_1} = \frac{59.23 \times 45.625}{2361.963} = 1.1441 \text{ ft.}$$

$$Y_1 = a_2 \cosh \frac{X_1}{a_2} = 59.23 \cosh \frac{1.1441}{59.23}$$

$$Y_1 = 59.23 \cosh 0.01931622 = 59.23 \times 1.00019 = 59.241253$$

$$D_1 = Y_1 - a_2 = 59.241253 - 59.23 = 0.011253 \text{ ft.}$$

$$ST = a_2 \sinh \frac{X_1}{a_2} = 59.23 \sinh 0.01931622 = 59.23 \times 0.019316 = 1.1441 \text{ ft.}$$

$$RST = RS + ST = 4.375 + 1.1441 = 5.519 \text{ ft.}$$

$$X_2 = a_2 \sinh^{-1} \frac{RST}{a_2} = 59.23 \sinh^{-1} \frac{5.519}{59.23} = \sinh^{-1} 0.093179 = 59.23 \times 0.09308 = 5.513 \text{ ft.}$$

$$Y_2 = a_2 \cosh \frac{X_2}{a_2} = 59.23 \cosh \frac{5.513}{59.23} = 59.23 \times \cosh 0.09308 = 59.23 \times 1.004338 = 59.486939$$

$$D_2 = Y_2 - a_2 = 59.486939 - 59.23 = 0.256939 \text{ ft}$$

$$D_3 = D_2 - D_1 = 0.256939 - 0.011253 = 0.245686 \text{ ft. or } 2\tfrac{15}{16} \text{ in.}$$

Therefore, the insulator sag is $2\frac{15}{16}$ in. for a total span of 100 ft.

The insulator sag is then added to the wire sag to obtain total sag.

The tests made showed the calculations to be accurate within a few percent. In most cases it is desirable to have a relatively small sag in substation strain buses. This calculation is of value in obtaining the tensions required for supporting structures.

Curves can be made for specific conductor size and insulator string length which show various sags and tensions for different span lengths. Fig. 2 shows a sample of these curves and a sample calculation.

Measuring D.C. INSULATION RESISTANCE and CAPACITANCE

LOREN H. HUTCHINS, JR., *Assistant Cable Engineer, Simplex Wire & Cable Co., Cambridge, Mass.*

Convenient assembly of test equipment for quality control offers useful service in manufacturing plants producing wire and cable—Operating company laboratories offer further field of use

ONE of the most important and hence most frequent measurements made during the manufacture of wires and cables is that of insulation resistance. Not only do specifications for all types of cables fix minimum limits therefor, but such tests constitute one of the fundamental criteria of insulation quality. Since the so-called "megohm constant" of different insulating compounds varies widely, judgment of what constitutes normal and subnormal resistance must be based on production experience. Hence, new compounds are always exhaustively studied before limits are set for testing department personnel.

Because of the absorption and polarization characteristics of insulating materials the standard 1-min. resistance value does not always tell the whole story. When additional proof of quality is necessary, as it is when conductors are destined for special types of cables, a far more searching measurement is made—electrification. This test consists in following dielectric charging current by galvanometer for 15 min.; the conductor is then grounded through the galvanometer for 5 min. and the discharge current noted; a reversed-polarity charging voltage is finally applied, and the resulting deflection recorded for another 5 min.

Capacitance Measurement

Another d.c. measurement is an important requisite of quality control. Since dielectric constant is a very important property of insulating materials, on either low-voltage communication or high-voltage power cables, inductive capacitance is measured as a routine factory test. This is done very conveniently and with sufficient accuracy by the simple direct-deflection method of comparison. That is, the capacitance of a length of insulated conductor is compared to that of a standard condenser by discharging first one and then the other through a galvanometer, following a charging period from the same battery, and observing the resulting throws.

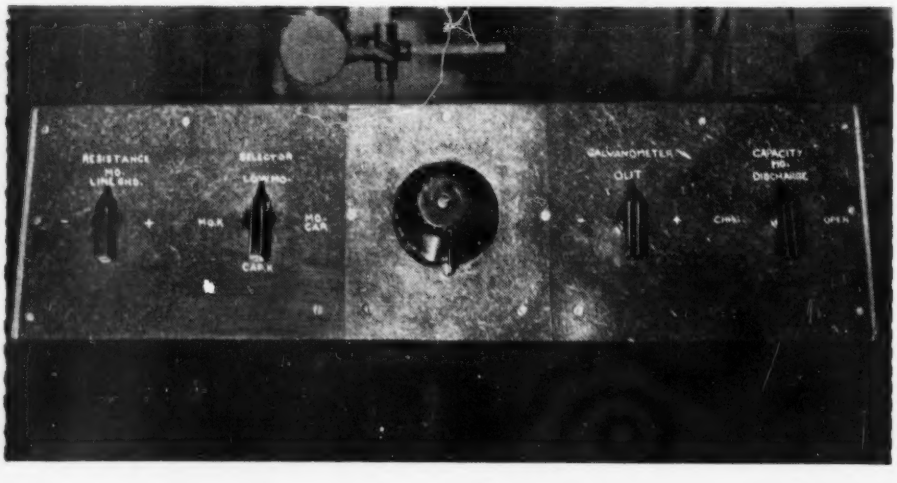
Both resistance and capacitance tests have a common relationship in that they may be performed very efficiently by means of a galvanometer and Ayrton shunt combination. With many such measurements to be made in the course of a day, a factory testing department must have equipment that will allow this work to be done with as much ease and dispatch as possible. The combined resistance-capacitance set described below meets very satisfactorily all essential physical and electrical requirements.

Test Set Details

Electrically, the test set is very simple indeed. The schematic circuits for the various tests and calibrations are shown in Fig. 1. In a close-up view of the operating panel are shown the locations of the controls necessary to the operation of the set. The circuit elements consist of four switches of the multiple-gang, low-loss type and an Ayrton-type shunt. The switches have proved ideal for this particular application, for they exhibit practically no inter-contact leakage—a most important requisite for this type of measurement. Excessive "set leakage," especially in humid weather, will make testing very difficult.

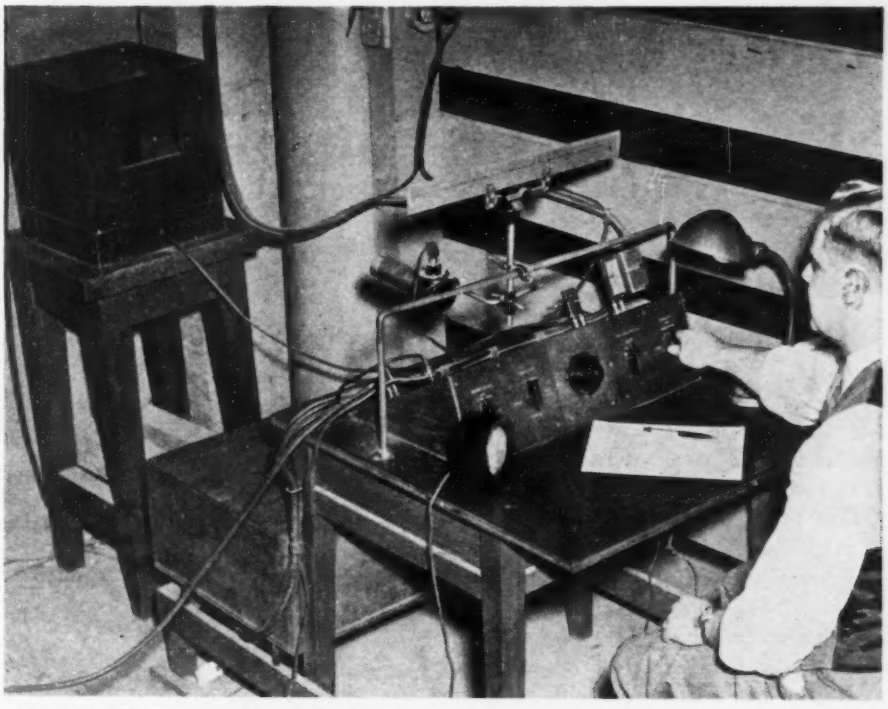
The switch at the extreme left con-

CLOSE-UP of operating panel of test set; switch controls indicated



trols voltage application, and the polarity impressed, during resistance measurements and resistance calibrations. The switch at the right of this is used to select the proper circuit for whatever test may be contemplated. The galvanometer shunt, mounted in the center of the panel, has a value of 10,000 ohms and is variable in 15 steps. The next switch disconnects and reverses the galvanometer. The switch at the extreme right controls voltage application and removal during capacitance measurements on either the standard condenser or on cable. The calibrating capacitors plug in at the top of the panel box. Inside the box is a heating bulb that insures moisture-free paths between all metal elements of the set. All connecting posts are mounted in low-loss bakelite insulating material. Galvanometer, lamp, and scale are conventional.

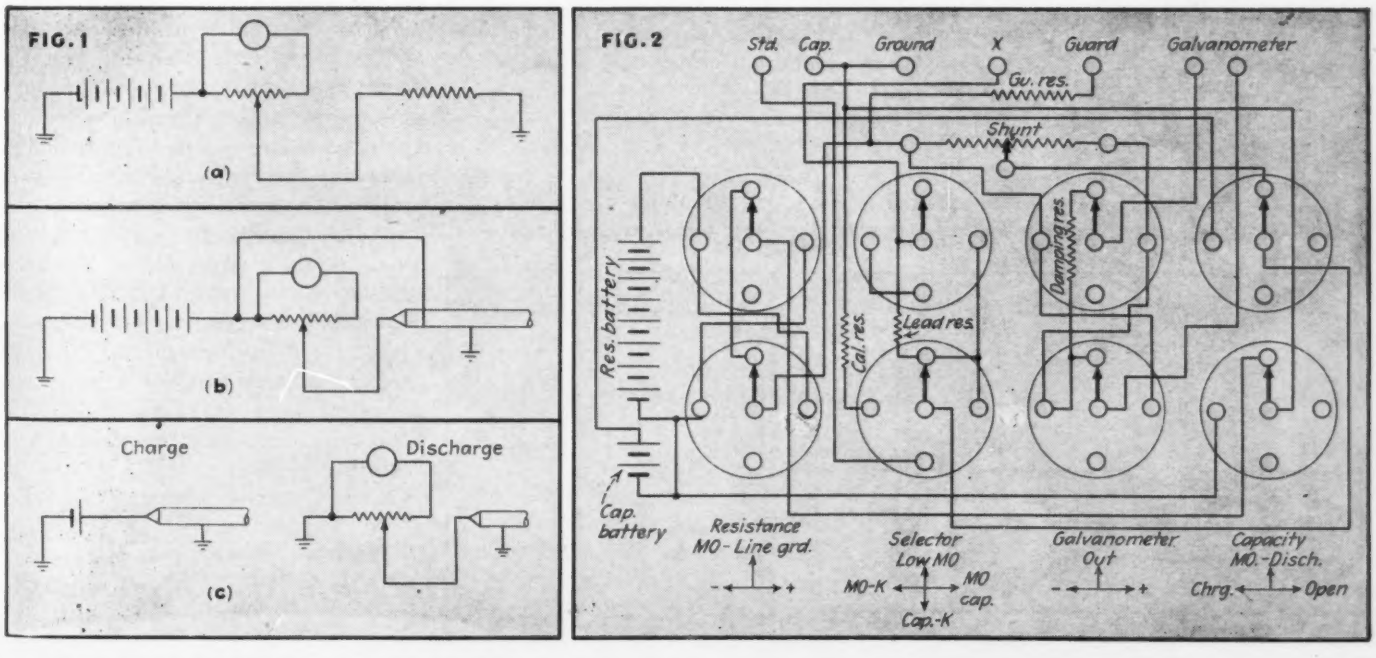
The voltage supply for resistance measurements (Fig. 2) consists of twelve 45-volt standard "B" batteries, and for capacitance measurements three 1½-volt dry cells. The calibrating resistor is 1.0 megohm, wire-wound. A similar resistor, of 0.1-megohm value, is inserted in series with the test lead when low-resistance measurements are made, for protection of the galvanometer. When the galvanometer is removed from the circuit, a 10,000-ohm resistor, also wire-wound, is placed across it to maintain constant damping characteristics. The guard circuit has a series resistor in it, also 0.1 megohm wire-wound, for protection of the set in the event it should become grounded. The standard condensers are high-quality mica units of 0.1 and 0.2 microfarad.



TEST SET in operation. Whether in factory production department test or in utility laboratory the unit is economical in space requirements and developed with relatively few parts for manipulation

The position of the control panel permits easy manipulation (illustration above) of the switches and shunt, also allowing ample room for recording data. All batteries, completely enclosed, are situated on the platform at the front of the table. The entire operating box can be removed as a unit, and another set in its place, when servicing is necessary. The galvanometer is totally enclosed to minimize external disturbances. Stability is of such a high order mechanically and electrically that a galvanometer constant as high as 3,000,000 megohm-millimeters has been used with this type of test set with no sacrifice of available precision and accuracy. Even greater sensitivity could be used if necessary.

FIG. 1—Schematic diagrams for (a) resistance calibration, (b) resistance, and (c) capacitance measurement . . . FIG. 2 Complete wiring diagram of test set. Respective switch positions are shown at bottom, as indicated on close-up view



SOUTHWARK STATION
Aimed to be Simple and Reliable II

L. R. GATY* *and* E. B. SHEW†, *Philadelphia Electric Co.*

Electrical layout, like mechanical design, directed toward safety, simplicity and reliability—Sectionalized ring bus has phase isolation—Air circuit breakers used throughout—Fast fault-clearing in switchhouse—Test and transfer bus for outgoing lines

SOUTHWARK PLANT[1] is located in an industrial area where considerable expansion can take place and not far from the central business district of Philadelphia, so that considerable load can be supplied from the new plant at generated voltage. Initially this will be approximately 65,000 kw. and will increase considerably in the ultimate development. However, with both the initial 300,000 kw. and the ultimate doubling of this capacity, there will be an excess of generation over local distribution which will be introduced into the major transmission system initially through three 100,000-kva., 69-kv. underground cables, each of which will be supplied by a 100,000-kva., 13.8-69-kv. tap-changing-under-load three-phase transformer.

Design Philosophy

Considered to be of prime importance in design of the electrical facilities of a steam generating plant in which the keynote is reliability and simplicity are the following fundamental features:

1. Safety to both personnel and equipment.
2. Phase isolation and physical segregation.
3. Simplicity in electrical connections and physical arrangement.
4. Use of non-combustible electrical insulating materials.
5. Selection of apparatus requiring minimum maintenance.

It was believed that an arrangement that would be free of fire and explosion hazard and at the same time safe, simple and inexpensive to operate would be attained if the above five points were followed. Accordingly the following features were agreed upon by the designers and prospective operators:

1. Air circuit breakers to be used throughout.
2. Power conductors to be bare copper supported on ceramic insulators.
3. Individual phase conductors to be completely enclosed by metal, so constructed as to virtually exclude dust and dirt.
4. Each section of the main 13.8-kv. bus with its associated breakers and other equipment and each bus sectionalizing breaker to be enclosed in an individual room.
5. Separation of adjacent rooms to be provided by corridors; access doors to different rooms not to be opposite each other.
6. High speed clearing of faults in the switchhouse.

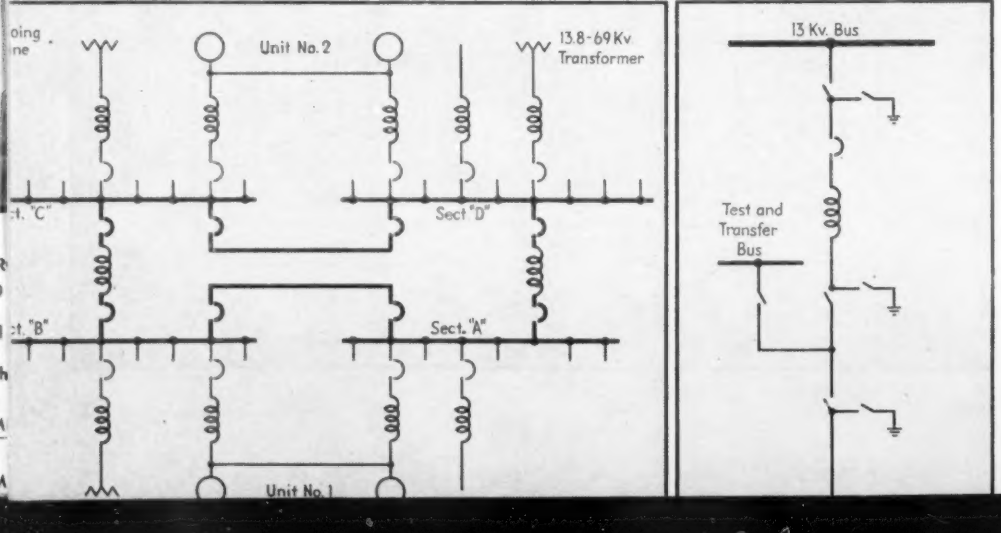
13.8-Kv. Ring Bus

In line with other generating stations on the system and in order to provide adequate flexibility in the operation of the plant, it is desirable that the generators, connections to the bulk power system, and the outgoing load be connected to a bus. A number of years ago the company started a program of modernizing generating station switchhouses by converting the usual sectionalized double 13.8-kv. buses to a ring type of bus. A number of different arrangements were reviewed for Southwark and of all these it was considered that the arrangement shown in Fig. 1 would provide the optimum in simplicity, reliability and flexibility. Two circuit breakers in series are provided between adjacent

* Electrical Engineer.
† Engineer of Inside Plant.

[1] For the philosophy of mechanical design see the first installment in ELECTRICAL WORLD, June 22, 1946.

FIG. 1—One-line diagrams of Southwark layout . . . (a) Major connections of 13.8-kv. equipment . . . (b) Typical outgoing line and transformer circuit



bus sections so that the failure of one will render only a single bus section inoperative. The two generators of each unit are solidly tied together electrically and two breakers provided for connection to the bus sections. The need for two paths from each unit is dictated by the maximum circuit breaker current rating that can be obtained, which is 5,000 amp. In event of the loss of one bus section with its associated generator breaker the remaining breaker will carry the output during the short time required to reduce the generator load to the normal breaker rating of approximately 120,000 kva.

Each of the outgoing lines, of which there is space for 25, and each of the step-up transformers can be connected to a 1,200-amp. test and transfer bus through disconnecting switches. (See Fig. 1b). This permits applying tests to any cable without the use of portable jumper cables and also provides a means for supplying one or more cables from one of the main transformers which may be desirable under certain emergency conditions or to allow inspection or maintenance work to be performed on a breaker, reactor or on a main bus section. To provide ample flexibility in the use of the test and transfer bus, it is sectionalized by disconnecting switches into four parts corresponding to the four main bus sections.

13.8 Kv. Circuit Breakers

Short circuit studies based on the ultimate plant development show that breakers having an interrupting capacity of 2,500,000 kva. would be required; the 5,000-amp. rating corresponds to the current-carrying requirements of these circuits. Calculations indicate that rate of rise of recovery voltage will be in the order of 12,000 volts per micro-second. For the outgoing lines, breakers having an interrupting capacity of 500,000 kva. are required, assuming that faults will occur only on the load side of the reactor.

Should a fault occur on the bus side of a reactor it will be within the bus differential relay zone of protection and will result in interruption to the entire section of the bus involved, but will result in minimum loss of load because lines from the remaining bus sections will carry the load on an emergency basis. The current rating of 1,200 amp. is suitable for supplying two cables rated 9,000 kva. each.

All of the breakers are of the compressed air type, mounted in steel cells. A common header type of air system supplied by four compressor units provides a high degree of reliability and permits all of the breakers in a given section of the bus to be operated seven times with the compressors shut down, including the two operations provided in each individual breaker tank.

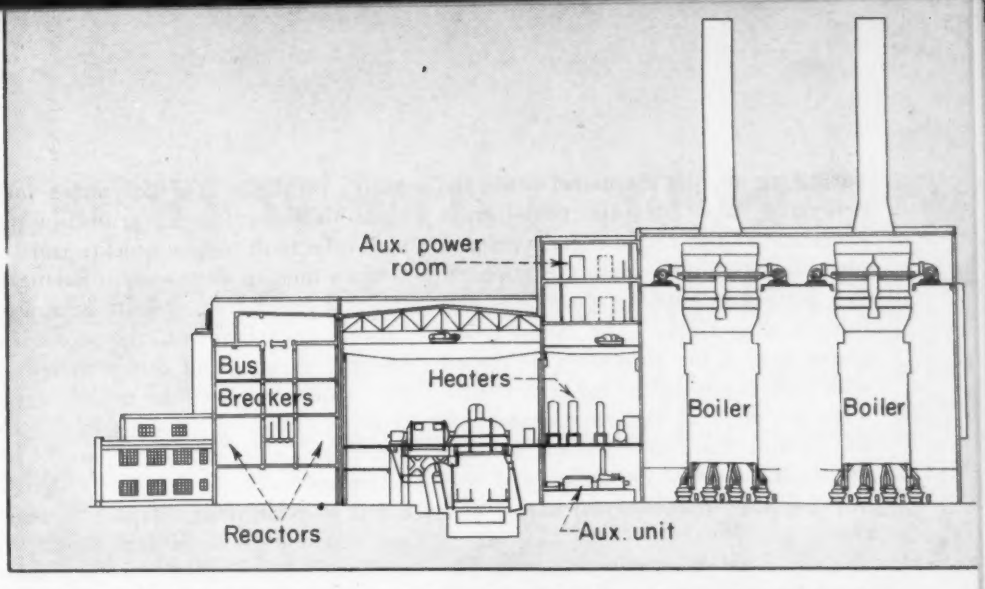


FIG. 2—Auxiliary power rooms are at two elevations above the heater bay

13.8-Kv. Conductors

The 13.8-kv. conductors for the main bus and connections between bus sections are mounted in phase-isolated square metal enclosures of non-magnetic steel. Access plates are bolted in place to make them reasonably dust-tight without the use of gaskets. The conductors to and from the reactors and in the disconnecting switch com-

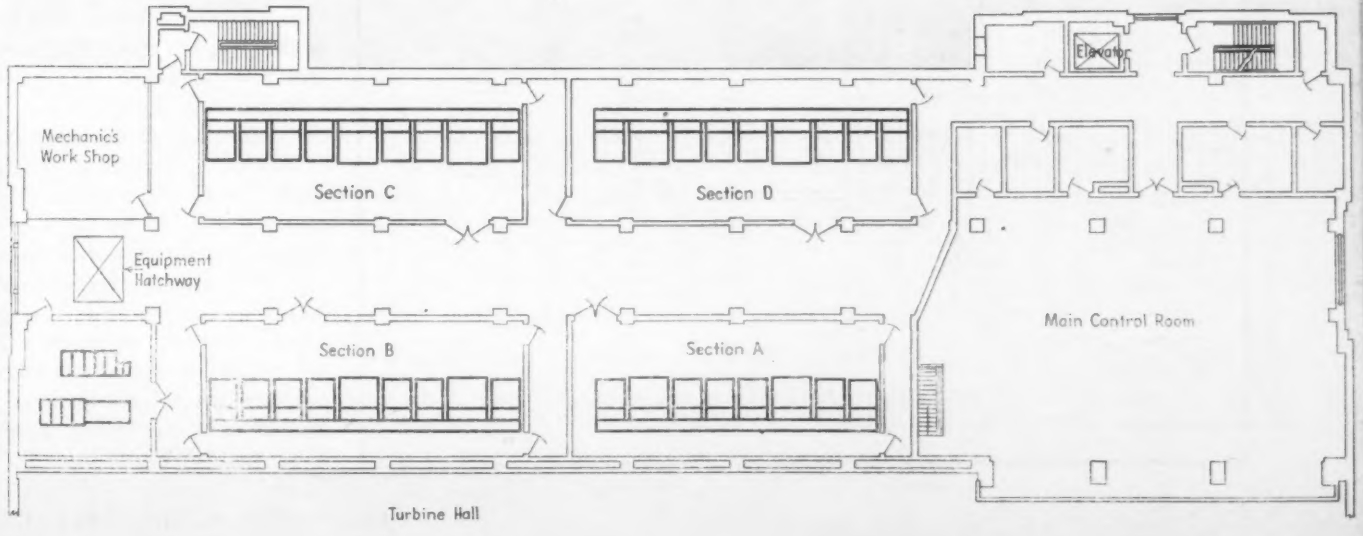


FIG. 3—Plan of switchboard at main bus and breaker floor; the 4,160/480-volt unit substation in lower left corner. Breakers are compressed air type

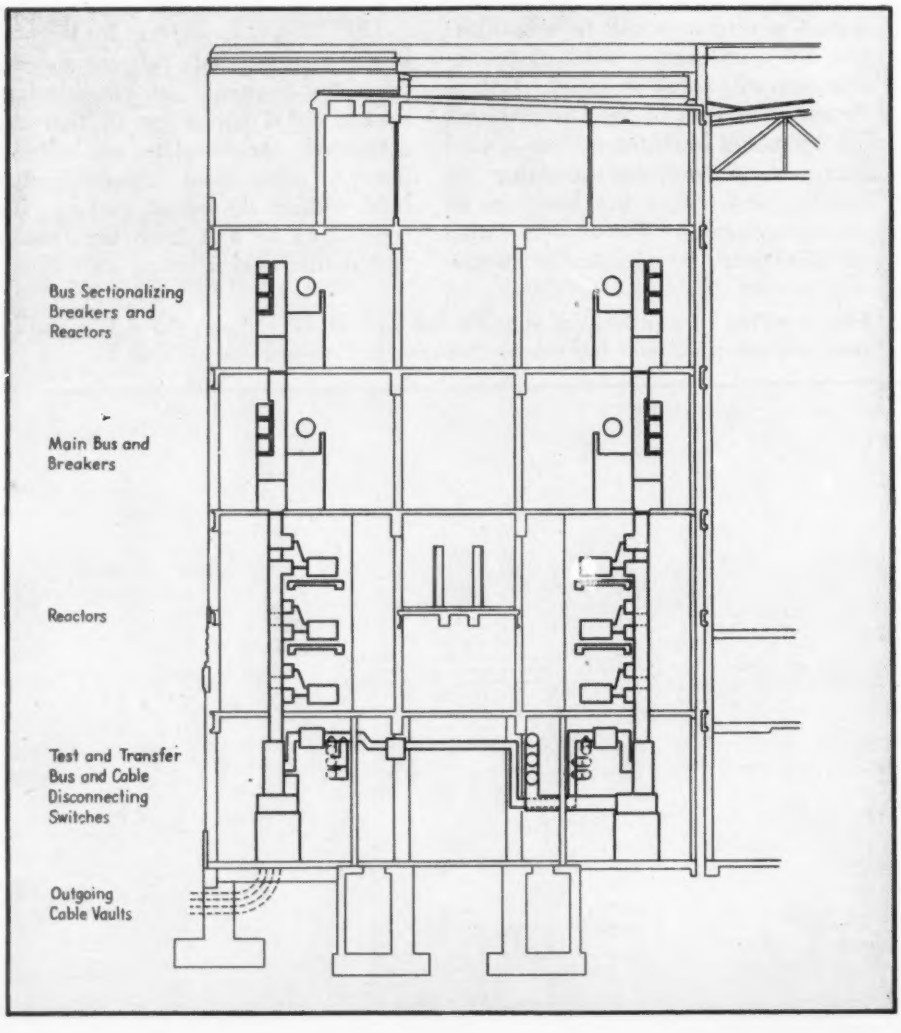
partments in the basement and the generator and step-up transformer leads are of the round metal enclosed phase-isolated type with the supporting insulators mounted on cast aluminum alloy rings. The round cover plates are $\frac{3}{16}$-in. aluminum equipped with gaskets and bolted together tightly with the ends of the runs sealed off by ceramic discs or bushings so that the enclosures are dust-tight and will not require frequent inspection and cleaning.

There is at least two inches of air space between adjacent phase conductor housings, including the disconnecting switch cells at the rear of each circuit breaker. The barriers between adjacent poles of each breaker consist of a single sheet of steel but an air space is provided between adjacent breakers. This type of enclosure gives assurance that every fault will involve ground. It is recognized that two phases can fail to ground simultaneously, resulting in a polyphase fault, but with the rapid relay protection provided the fault will be quickly isolated.

On a metropolitan system having an internal generating capacity of approximately 1,600,000 kva., the problem of keeping short-circuit duties to reasonable values requires the use of current limiting reactors, particularly when generators are operated in parallel and connected to the bulk power system by a bus at generated voltage. In selecting reactance values for Southwark, recognition was given to voltage drops through the reactors and some compromises were necessarily made with the desire to reduce fault duties to minimum values. These considerations resulted in reactors of the following ratings being provided:

	PERCENT	AT KVA.
Generators and Bus Sectionalizing	5	110,000
Main Transformers	1.5	120,000
Outgoing Lines		
Substation Service	7.5	18,750
Industrial Service	10	15,000
Station Service Supply	5	12,500

FIG. 4—Cross-section of switch house. Relay boards located in enclosed corridor on mezzanine of reactor floor. Disconnects have key interlock system


Bus Sectionalizing Breakers and Reactors
Main Bus and Breakers
Reactors
Test and Transfer Bus and Cable Disconnecting Switches
Outgoing Cable Vaults

Calculations indicate that the maximum three-phase duties, using the above reactor sizes, will be 1.10 mva. on generator breakers, 2.25 to 2.50 mva. on transformers and bus sectionalizing breakers and 0.23 mva. on outgoing line breakers.

Disconnecting Switches

In keeping with the desire to provide safe operating conditions, all disconnecting switches in the switchhouse are group operated with manual control. The use of group operation and metal enclosures provides a barrier between the operator and the switch and also permits the ready application of a key interlock system which is incorporated in this station. There was originally considered a complete interlocking plan which would direct every operation of the power and ground disconnecting switches, but in order to take care of certain contingencies it would have been necessary to violate portions of the scheme. This was considered to be highly undesirable so that the plan finally adopted contemplates only directing the operator to the proper circuit. This is accomplished by obtaining a key from the main control room which will fit only one circuit breaker and can be operated to release another key only when that circuit breaker is open. The key thus obtained can be used to operate any disconnecting switch (power or ground) in the particular circuit involved and in any sequence. The corresponding main bus grounding switch mechanism is unlocked by a second key released from each breaker. These keys are captured while the bus grounding switches are closed and must be returned to their respective breakers before the breakers can be closed.

The scheme gives complete assurance that the operator will be directed to the proper section but does not control the sequence of operating the switches. It does prevent opening a disconnecting switch under load and from closing a ground switch with the main bus breaker closed. Further, it prevents the closing of the main bus grounding switches on a live section of bus and also prevents energizing a main bus section while it is grounded. Thus, incorrect operation will not involve any of the main bus sections.

Other electrical features will be treated in a concluding installment in ELECTRICAL WORLD, July 20.

TORQUE SCREW POLE TESTER
Graphs Condition of Standing Poles

HOWARD A. STINGLE, *Engineer, Washington Water Power Co., Spokane, Wash.*

Resistance to turning of a probe screw is recorded on a graph in pound-inches to indicate condition of the wood in a pole

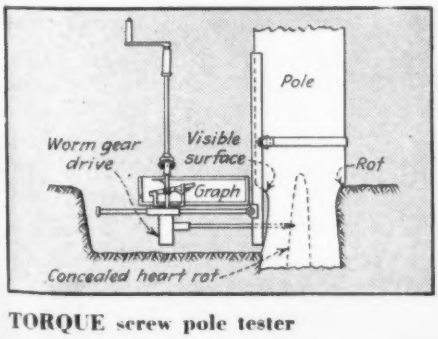
A DEVICE known as The Torque Screw Pole Tester has been developed for providing a graphical record of the condition of the wood in a standing pole. Soundness of the wood and the presence of surface rot or heart rot determines the strength and remaining life of the pole. A record of these conditions therefore indicates the remaining service to be expected from such a pole and also by study indicates the time for removal or repair.

As the probe is screwed into the wood of the pole as illustrated, the resistance to turning is recorded on the graph in terms of pound-inches. A typical actual graph is shown. By comparison with an average value for new wood, the graph will indicate the relative condition of the pole being tested. It requires about ten minutes to make a test on a pole. Where the test is to be made below the ground line, some dirt must be removed from one side of the pole to permit the probe to penetrate the wood at the desired point.

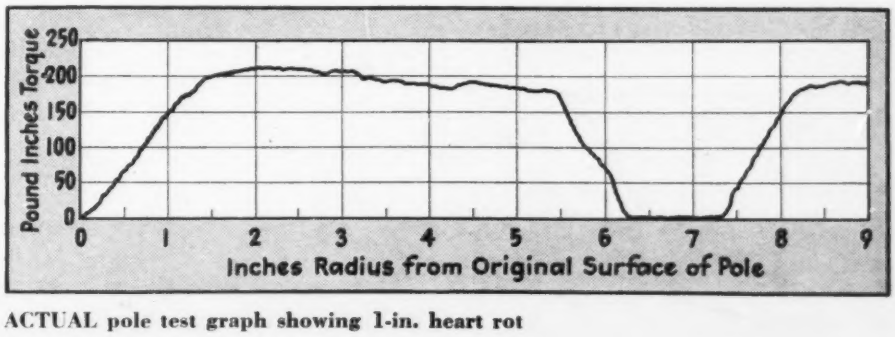
This device was developed at Washington State College in cooperation with the Washington Water Power Co., which later used it extensively in field tests on transmission and distribution pole lines involved in Public Utility District condemnation proceedings. Results of such tests with this instrument are especially valuable because they do not rely upon the personal skill or experience of the operator. They also indicate the internal condition of the pole, which condition would frequently escape the attention of an inspector using a hand probe. The records obtained from field tests can be filed in the office, available for future reference or comparison with later tests.

The Torque Screw Pole Tester has been assigned to the Washington State College Foundation which is arranging for its manufacture and sale.

AS CRANK on torque screw tester is turned, resistance to driven probe registers on graph shown to indicate amount and location of pole rot



TORQUE screw pole tester



ACTUAL pole test graph showing 1-in. heart rot

Engineers Confer at Detroit On Diversified Current Issues

A.I.E.E. Summer Conventions Resumed—Program Focuses Attention on Excitation Systems, Servomechanisms, Industrial Heating and Controls, Cable Insulations and Sheaths, Protective System Performance and High Temperature Dielectrics

AFTER a one year intermission occasioned by the war the American Institute of Electrical Engineers again has held its summer convention with a solid technical program of papers. The location was Detroit and the period the week of June 24-28, 1946.

Topics were well spread over the range of interest of the members in the power and industrial utilization fields with a sustained amount of time devoted to round table conference periods. These again afforded freer play for questions and informal discussion than is often the case with formal paper sessions. Such conference periods of outstanding import were those devoted to experience with switching capacitors, to the evolution of electronic instruments for industrial purposes and to supervisory control of air switches.

Among the sessions devoted to presentation of formal papers the significant ones were those in which there were presented discussions of new cable trends, committee reports on relaying, a pair of papers on excitation systems and a discussion of new developments in the field of industrial control.

Classical treatment of the coordination of insulation and conductor spacing on the T&D program and of the functional pattern of electrical measurement marked two of the other sessions. Recognition was accorded to the growing importance of servomechanisms and the province of the new committe on this subject by scheduling a four-paper session. These were framed to broaden the base for specific cultivation of the new art.

The ensuing discussions are reported in terse form for study by most readers during the week immediately following the well attended A.I.E.E. meetings.

Power Generation

Improvements in Performance of Hydro-Electric Generating Units on the 2,000,000-Hp. Saguenay System. F. L. Lawton, Aluminum Co. of Can.

Alterations in blade shape, gate opening indicators, removal of dirt from generators, bettered insulation and ventilation safely enhanced outputs and improved performance generally.

Tennessee Valley Authority Hydroelectric Stations. R. A. Hopkins and H. J. Peterson, both TVA.

Resume of numerous design features characterizing the newest 14 plants.

Modern Excitation Systems for Large Synchronous Machines. J. B. McClure, S. I. Whittlesey, and M. E. Hartman, all General Electric.

Comparative analysis of excitation systems, exciters, rheostats and regulators with special emphasis on voltage regulators.

The Development of Modern Excitation Systems for Synchronous Condensers and Generators. F. M. Porter and J. H. Kinghorn, both Amer. Gas & Elec. Service.

Analysis of the included performance of four electronic main exciters and five pilot exciters led to adoption of Amplidyne control (with electronic excitation) for 18,750-kva. synchronous condenser (900 rpm.) to work with direct-connected exciter in 25-psi. hydrogen.

Comment on the papers by Lawton and by Hopkins and Peterson revolved mainly around the desirability of keeping generators clean and the superiority of cast steel over cast iron for turbine runners. On the first point, H. R. Sills, (Canadian General Electric) said that there was a real need for published data on the effects of dirt in generator cooling systems and he welcomed the Lawton paper because of the attention it gave to the matter. J. F. Roberts (Allis-Chalmers) in a discussion read by Soren Mortensen doubted that cast iron would be given any consideration as a runner material in future design of large machines in view of the demonstrated better performance of cast steel. Additional interesting details on the design of some TVA generators, supplementing the Hopkins and Peterson paper, were presented by Mr. Mortensen.

Conclusions reached in the Porter and Kinghorn paper as to cost of electronic excitation, said A. A. Johnson and R. F. Lawrence (Westinghouse) in a jointly prepared discussion, may be modified when the over-all system costs of the operation of each exciter scheme are considered particularly in regard to generator, as opposed to condenser, excitation. C. E. Valentine (Westinghouse) said that better tube performance may confidently be expected and his opinion was seconded by H. C. Steiner (General Electric) who offered several groups of data on tube life and indicated a life of four to five years is not an unreasonable expectation. Despite present interest in these later developments in excitation methods, the direct connected exciter is here to stay, especially for low and medium speed machines, said J. B. McClure (General Electric). The point of desirability of automatic changeover to battery or other standby supply in case of failure was brought up by S. Beckwith (Allis-Chalmers) but this was discounted by the authors of the paper. The diversity of devices and schemes in the later developed methods of excitation led E. L. Harder (Westinghouse) to hope for an early approach to some sort of standardization in them.

Discussion of the McClure, Whittlesey and Hartman paper included a sug-

gestion from J. H. Kinghorn (American Gas & Electric Service) that the "electronic pilot exciter" be listed among the types named in the paper.

Cables

Determination of Cable Temperatures by Means of Reduced Scale Models. A. Gemant and J. Sticher, both Detroit Edison.

Successful experiment in box 15 x 5 x 4 ft. indicates that quick indications of temperature gradients can be found for earthed or ducted cables.

F-3 Lead Alloy—An Improved Cable Sheathing. L. F. Hickernell and C. J. Snyder, both Anaconda.

Arsenical (0.15) lead (99.65) containing tin (0.10) and bismuth (0.10) tests, extrudes and ages well, promises life free from most troubles with other lead compositions.

Semi-Conducting Shielding for A.C. Power Cable. E. J. Merrell, Phelps-Dodge.

Transmission hyperbolic expressions used to plot design graphs recognizing charging currents, thermal surface resistance, corona factors toward improved performance of shielded cables.

High-Voltage D.C. Testing of Rubber-Insulated Wire. W. N. Eddy and W. D. Fenn, both Simplex.

Suggests as limit 50 percent of the 5-ft. sample impulse strength or 500 volts/mil on rubber and 750 volts/mil on polyethylene if impulse strength is unknown.

Moisture Equilibrium between Gas Space and Fibrous Materials in Enclosed Electrical Equipment. J. D. Piper, Detroit Edison.

Even with tape moisture content reduced to 1.7 percent, moisture in gas showed dew points fluctuating with seasonal temperatures. The indicated equilibrium is recorded in a family of charts.

Much of the discussion entailed confirmation of the claims made for the new F-3 lead alloy in the Hickernell-Snyder Paper. Herman Halperin (Commonwealth Edison) called it the first lead with all-round advantages and apparently few adverse properties. In Chicago the intention is to keep upping the loading, and that will call for the best of sheaths. Dummy manhole tests, he said, confirmed the data set forth on F-3. H. S. Phelps (Philadelphia Electric) concurred in general, but mentioned the tendency of all lead alloys containing admixtures of more than 1/10 percent to fail in the welds. He called F-3 less ductile and more prone to result in internal pressure failures, but despite this the alloy promises to triple sheath life. G. B. Shanklin (General Electric) classed arsenical leads in the age softening group, and said precise control is necessary to avoid ultimate hardening or softening since stability is the real objective. Long experience has shown, said Shanklin, that copper-bearing lead can function up to 150 psi. without undue creep.

Long search for an escape from double-sheathing seems to be ended with the advent of the new alloy, said C. T. Hatcher (Consolidated Edison). Several field installations seem to confirm the claims made for F-3, said G. B. McCabe (Detroit Edison), who desired to record that calcium leads also show quick attainment of stabilized tensile strength. He suggested that calcium content could apparently be reduced to 0.02 and improve the ductility without impairing other properties. He hoped the new arsenical alloy would be obtainable from all cable manufacturers.

Some skepticism was expressed about the load applicability of the method of reduced scale models advanced by Gemant and Sticher for predicting cable temperatures. Halperin rated it as an additional tool rather than a supplanting one. Hatcher also called it insufficiently flexible to be appropriate for a wide variety of cable assemblies and duct configurations.

On the matter of moisture content Abe Tilles (Pacific Gas & Electric) welcomed the Piper contribution because, as he put it, everybody has a morbid interest in the whereabouts and intentions of the last vestiges of moisture in any high-voltage insulation.

Relays

Low-Current Secondary Current Transformers. Relay Subcommittee.

Recommended only for special cases where the secondary lead burden is large and causes otherwise intolerable errors. No justification for standardization found.

Protection of Powerhouse Auxiliaries. Committee on Protective Devices.

Questionnaire report (11 companies). Mostly transformer source with differential protection. Long time delay on 2,300-volt motors, thermal on smaller sizes (experience not the best). Preferred practices recommended.

Fault Location and Relay Performance Analysis by Automatic Oscillographs. H. P. Dupuis and W. E. Jacobs, both Commonwealth & Southern.

Technique of computing maximum ground fault current curves, impedance curves and ratio curves and their use in locating faults by oscillograph analysis.

Operating Experience with Distance Ground Relays. W. A. Wolfe, Kansas Gas & Elec.

Reports excellent performance of distance ground relaying; of 378 operations on 10 lines in 8 years there were 11 wrong and 2 questionable. Carrier obviated.

Discussion of distance ground relays showed satisfaction with their use, but there is room for improvement in the design of the relay. B. C. Hicks (Shawinigan Water and Power) sent in the comment that 20 years' experience with impedance relays was satisfactory while J. A. Elzi (Commonwealth & Southern) believes that simpler types of relays are usually adequate and that increased cost of distance relays may not be justified in many cases. I. T. Knight (Kansas City Power & Light) also expressed satisfaction with the experience record with distance ground relays on the KCP & L System.

This type of relaying should be more popular, in the opinion of R. E. Cordray (General Electric). E. T. B. Gross (Illinois Institute of Technology) suggested that the number of elements necessary, and therefore the cost, might be reduced. S. L. Goldsborough (Westinghouse) expressed the opinion that difficulties with distance ground relaying are in the use of reactance elements with impedance starting and with action of the reactance elements on two phase to ground faults.

Opinion was also expressed that interest is growing in oscillogram analysis for fault location. G. D. Floyd (Hydro-Electric Power Comm. of Ontario) confirmed experience outlined in the paper, but added that additional methods are justified to decrease the possibility of error. J. J. Tesar (Cleveland Electric Illuminating) said that they have helped this method by developing long rolls of film by the rack method using contrast developer.

W. R. Brownlee (Commonwealth & Southern) feels that practice in powerhouse auxiliaries is more divergent than indicated in the committee report. He questions need of thermal and undervoltage relays in power houses, where maintenance is of the best and loading is controlled. John H. Miller (Weston Electrical Instrument) feels that standards should be set up for low current secondary current transformers because they are still called for by some utilities.

Servomechanisms

Electrical Accuracy of Selsyn Generator-Control Transformer System. Harold Chestnut, General Electric.

Mathematical analysis of the sources of static and kinetic errors. System capable of 0.2- to 0.3-deg. static accuracy. Kinetic errors are of order of 1 deg. per 320 rpm. at 60 cycles, less for 400 cycles.

The Frequency Response of Automatic Control Systems. Herbert Harris, Jr., Sperry Gyroscope.

Adaptation of N.D.R.C. report. Advocates frequency response method, using Fourier Series and Integral, as more facile than transient analysis in determining the characteristic equation.

Parallel Circuits in Servomechanisms. H. T. Marcy, Mass. Inst. of Tech.

Servomechanism components treated as 4-terminal network along with discussion of compensating networks

Dimensionless Analysis of Servomechanisms by Electrical Analogy. S. W. Herwald and G. D. McCann, both Westinghouse.

Presents study of variable-voltage, angular-position servomechanisms carried out on transient analyzer; pertinent to cases of two time delays and error or error-plus-error-rate functioning.

Sponsored by a new joint committee in recognition of an equally new art promising to cut across all industrial operations was a session devoted to the mathematical tooling of servomechanism analysis. The group at the meeting was large and widely diversified in interest. In fact, discussion of the papers had not proceeded far before the industrial engineers present indicated that the experts were talking an unrecognized language. J. D. Leitch (Electric Controller & Manufacturing) spearheaded the effort to have the gap bridged and the concepts translated into the needs of the steel mill or paper mill engineer. G. W. Heumann (General Electric) interjected the idea that industrial interest is much more a matter of maintenance of speeds than of precision of position, especially when shock torques tend to deflect the speeds from desired valves. Harris rejoined that the criterion is whether the shock throws the system outside its linearity bracket.

Professor C. N. Weygandt (University of Pennsylvania) warned also that the alternating current likely to be involved in industrial applications makes the solution even more intricate than direct current. Marcy admitted this difficulty for small combustion engine drives encountered in the field explored by the first three papers. Harris said that industrial process controls almost always introduce interactions and lags beyond those encountered in typical electrical filter and amplifier systems. For variable speed drives it was, Harris said, often a dilemma whether to remove inertia to get early balance or whether to add it for the sake of better self-regulating characteristics.

Professor Gordon Brown who presided and who heads the joint committee promised that the program will evolve in the direction desired by such collaborating groups as the industrial, machinery, measurement, control and basic science committees. The gaps disclosed by this initial symposium will be bridged. One step in this direction will be the early publication of the series of papers on servomechanisms presented at a forum held by the New York Section of the Institute. In this way it is hoped that the generalizations arrived at by the specialists who solved the intricate controls for planes, guns, radar, etc., can be made practically usable by engineers concerned with controls in everyday industry.

Industrial Applications

Low-Reactance Flexible Cable for Induction Heating. Myron Zucker, Mackworth G. Rees, Inc.

Gives electrical properties of interleaved cable having the outgoing conductors in clover-leaf configuration and insulated from return conductors in crotches of clover-leaf.

Design of Induction Heating coils for Cylindrical Magnet Loads. J. T. Vaughan and J. W. Williamson, both The Ohio Crankshaft Co.

Supplemental equations take cognizance of variation in impedance with change in load temperature of magnetic material heated by induction.

Electronic Register Control for Multicolor Printing. W. D. Cockrell, General Electric.

Designed for precise five-color register despite variations due to cylinder diameter, paper stretch or shrinkage, flying paste joint and acceleration period. Phototubes and thyratrons.

Significance of the two high frequency papers was emphasized by N. R. Stansel of General Electric because he foresees an increasing interest in distributing such currents and a corresponding need for engineering discussion to match the attention given recently to the utilization and generation aspects. In fact he called the Zucker paper practically the first contribution. He pointed out that resistance of the leads is much more important than the inductive reactance because the latter can usually be overridden by capacitance. Williamson in comment on the same paper cited variation up to 30 percent between apparently identical cables, presumably due to oxidized surfaces of the strands. D. W. Kuester of the Naval Research Laboratory suggested enameled interwoven strands as a means of forcing optimum current distribution in the leads used for induction heating frequencies.

Much of the discussion on the Vaughan-Williamson paper centered on the issue of permeability under alternating excitation particularly in the weaker brackets of flux density. Stansel stressed the matter of transverse flux and said that the d.c. permeability values may be used for calculating the heat of most carbon steels provided adequate attention is paid to transverse flux and its bearing on the induced eddy currents. He also pointed out that the maximum power factor for the coupling of induction heating circuits is practically 70 percent but that slightly higher values are experienced in instances where transverse flux comes into play.

In extension of their paper the authors pointed out that there was little difference in efficiency of heating steels by means of frequencies of one, three or ten kilocycles provided the diameter is 3 inches or more; for diameter of 1 inch or less it is advisable to use 10 kilocycles to keep generator cost down. Capacitors, they emphasized, are much cheaper per kva than generators at the frequencies used for induction heating.

Industrial Applications

Protection of Industrial Plants Against Insulation Breakdown and Consequential Damages. H. R. Vaughan, Westinghouse.

Tells how to provide protection of industrial equipment against surges (lightning) and phase-to-ground faults toward achieving the freedom from interruptions characteristic of utility systems.

In recent years voltages of distribution primaries of utility systems have risen 5 to 10 percent and application voltages in industrial plants have gone up correspondingly. This has become a problem in many industrial plants where motors and other equipment rated in multiples of 110 and 115 volts are subjected to potentials considerably higher than those for which they were designed. Appreciating this problem, a subcommittee of the committee on industrial power applications is making a study of industrial voltage requirements. A progress report on this study was presented by J. Grotzinger. The subcommittee has established limits of voltage range at utilization equipment terminals for the customary nominal system voltages which will be published in a report now in preparation.

Discussion of the progress report

questioned the advisability of such wide ranges of utilization voltages as were shown in it.

In his paper on the application of protection devices in industrial plants, L. C. Peterman (Ford, Bacon & Davis) described a simply designed industrial system in which two sizes of single-phase distribution transformers and two sizes of individually enclosed air circuit breakers were combined into a great variety of different load center units, resulting in shortening equipment delivery time from four months to four weeks, as compared to packaged load center units. The system has a balanced design in which bulk supply feeders, transformers, switches and subfeeders are closely adjusted to load, with limited emergency capacity provided at nominal cost.

In the next few years much activity in the construction and modernization of large non-industrial buildings is to be anticipated, said D. L. Beeman (General Electric), and it is time now for the engineer to give thought to the problems of electrical distribution that will come up. Many of the advances made in industrial systems during the war years, high-voltage distribution, dispersed substations, factory-assembled equipment, are adaptable to use in non-industrial buildings, and with increases in air-conditioning and other loads heavier short circuit currents become an important factor in distribution design.

Electronic Recording Instruments

Three engineers representing as many manufacturers of recording instruments traced the evolution and state of the art of using electronic means to obviate the use of the earlier galvanometer. A fourth informal paper reversed the trend and told of a redesign of galvanometer for a photoelectric recorder devised for the meteorological arm of the Signal Corps.

A. J. Hornfeck (Bailey Meter), in discussing the evolution of the Pyrotron, said that measurement appears to be the most promising contribution of electronics to the industrial field. There is wide versatility in application and adoption. In the Pyrotron the motor control for the null balancing is based on phase shift. He also mentioned a moving-core impedance-bridge for primary detection and said that a whole family of ratio, multiplication and other types of recorders can be founded on the same basic elements. An electronic system of the null type has the advantage of drawing practically no energy from the measured quantity.

Some question was raised whether such amplification procedures did not put them in the category of servomechanisms.

W. P. Wills (Brown Instrument) reviewed the patent art from 1916 to 1946 concerning the field of conversion of the small magnitudes involved in measurement for recording purposes. Most of the efforts had been directed at elimination of moving or sliding contacts. He described the electronic continuous balance circuit with vibrating reed which is the basis of the Brown converter. The life is certainly well over five years as evidenced by the return of only eleven out of 6,000 in service during that period. He mentioned the new General Motors scheme for balancing by means of synchronized contacts.

Importance of the input transformer was stressed by A. J. Williams, Jr., (Leeds and Northrup) because if the quantity to be amplified is alternating the transformer can offer its inherent amplification function. He traced the evolution since 1929 and the gain achieved by resort to Permalloy, which is devoid of magneto-striction and therefore free of conversion of mechanical into electric noise.

The paper which reaffirmed the galvanometer was by V. L. Parsegian (C. J. Tagliabue Co.). Use of Alnico has reduced weight inertia and period to the point where sensitivity of 1/10 percent can be achieved with one-second traverse of a 10-in. chart. A photoelectric relay and compensation of the back electromotiveforce of the galvanometer are other adjuncts.

Industrial Control

Dynamic Braking Control of D. C. Series Motors—Calculation of Stability Limit. G. W. Heumann and W. P. Smith, both General Electric.

Per unit plots of motor characteristics facilitate choice of controls and determination of performance in such applications as crane hoists. Series resistance augments stability.

Silicone Resin Treated Magnet Coils. G. L. Moses, Westinghouse, and J. J. Torok, Corning Glass.

Three coils tested at 200 C., three at 225 C., 250 C. and 275 C., on a cycling basis lead to no coil failures after some 12,000 hours; the 200-C. units showed little aging, the 275-C. were apparently near failure. Confirms appropriateness of the silicone resin.

Fundamental Properties of the Vacuum Switch. R. Koller, University of California.

Tests of experimental vacuum switches at 50-500 volts indicate the desiderata to be achieved if they are to reach into medium and heavy currents. Current concentration at electrodes to be avoided.

An Electronic Drive for Windup Reels. K. P. Puchlowski, Westinghouse.

Design applied to shunt motor gives speed regulation (at 30 rpm.) of 4.16 percent with 230 percent final reel diameter.

The Moses-Torok paper was followed by much discussion which, because of its length and number of participants in it, can only be summarized here. Such conclusion as might be drawn from it, without in any way depreciating the great potentialities of silicone resin insulation, is that class A insulation will remain strongly in the picture for some time to come, particularly in the cases of coils wound with small diameter wire. Copper conductors operating at the high temperatures possible with silicone insulation oxidize quite rapidly and by thus reducing the conductor section increase its resistance and decrease the current carrying ability of the coil.

Oxidization of the copper also reduces adherence of silicone enamel and this consideration at present almost precludes use of the new insulation in this form. As copper resistance increases with temperature, there comes a point of coil heat when ampere-turns decrease as temperature increases. This factor is bound up with the consideration of heat dissipation from the coil which is dependent on the shape and dimensions of the coil. And then, as the coil becomes hotter, the heat dissipation factor improves. Is there a point of economic limit of temperature set by the I^2R of the coil? This question is of no practical significance as regards shunt coils, but it may be of moment in reference to series coils to which the applied voltage may be variable.

Tests so far made on silicone insulated coils have not yielded any significant data as to the effects of corona, but the indications are that this will not be an important consideration at utilization voltage levels.

O. K. Marti, Allis-Chalmers, comment on the Koller paper, which was presented by B. K. Northrop, Cornell University, in the absence of the author, indicated a considerable faith in the possibilities of the vacuum switch. He saw, from the work done by Koller in

interrupting comparatively small values of d.c., the possibility of handling much higher a.c. currents. This view was not shared by T. E. Brown, Westinghouse, who expressed himself as somewhat dubious about extrapolating the results of the Koller tests to higher current values.

The papers on philosophy and simplicity of relaying should be required reading for all engineers on both relaying and system planning in the opinion of E. E. George, Ebasco Services. The difference between California lightning frequency and that in the mid-west may be important in simplification efforts, said W. R. Brownlee, Commonwealth and Southern.

Measurements

Frequency Compensated A.C. Ammeters and Voltmeters. J. M. Whittenton and C. A. Wilkinson, both General Electric.

Compensated for 25 to 3,000 cycle range (aircraft and industrial field) by shunting an adjustable resistor with fixed capacitor. Data given for magnitude of R and C and for resulting accuracies.

Functional Analysis of Measurement. I. F. Kinnard, General Electric.

Classical characterization of the three-part composition (comprising primary detector, intermediate means and end device) into which practically all measurement technic falls. Suggested definitions and classifications.

A New Design for the A.C. Network Analyzer. T. D. Ryder and W. B. Boast, both Iowa State College.

All electronic pilot model uses 10,000 cycles to achieve minimized burdens, reduced values and sizes of circuit elements. Uses standard radio units rather than scaled-down power units.

High Vacuum Leak Testing with Mass Spectrometer. W. G. Worcester and E. G. Doughty, both General Electric.

Helium gas in conjunction with mass spectrometer locates and measures leaks over wide range of pressures and of shape of container.

Origin of the method of frequency compensation cited by Whittenton and Wilkinson was credited to Drysdale and Jolley by J. H. Miller, who added that the Model 326 Weston Laboratory Standard Voltmeter was compensated in the same way as early as 1920. The authors rejoined, however, that the Weston company had not divulged the details. Miller added that the method is practically limited to the 15-volt range without unduly large capacitors being necessitated. He also said that it is not an easy matter to compensate for incremental inductance arising from the movement of the iron into the coil of a moving iron instrument.

Kinnard amplified his paper on functional analysis saying it was the result of a 3-year study anticipating and paralleling the broad expansion of measurement into many fields adjoining pure measurements. It classifies the multiplicity of measurement principles and basic elements and culminates in a simulation of 94 functional parts to reassemble for the wide variety of measurement tasks impending in industrial processes. In answer to a question, Kinnard hoped that the classification will be a good stimulus toward standardization and adaptation of prevailing elements without engaging in the waste of reinvention.

Discussion of the Iowa State network board focused on the matter of the distributed capacitance introduced by the multiplicity of relay circuits. H. L. Clark (General Electric) also queried about the stabilization of the amplifiers outside the 10-kilocycle band. A representative of the Illinois Institute suggested that the Iowa State calculating board might be more feasible in the form of fixed elements simulating the actual quantities prevailing on a given utility system.

Single-Pole Switching

Operating Experience with Single-Pole Switching. I. T. Knight, Kansas City Power & Light Co.

Transient stability enhanced 30 percent by use of single-pole switching as well as relief of comparatively weak turbo-generator shafts on power swings. Complicated relaying justified.

Following the Knight paper N. H. Meyers (General Electric) described a newly developed method of control for air switches used to bypass ground fault neutralizers, usually known as Petersen coils. If a fault hangs on for a longer time than the coil is rated to stand, then the automatically controlled bypass switch closes, shuting out the coil.

F. W. Rich and M. S. Kirwen (Commonwealth & Southern) jointly presented a paper on automatic control of air switches for live sectionalizing and load transfer. They described these schemes. First was a method for load transfer with interlocking synchronism check, using d.c. potential for operation and control. Next was line sectionalizing and subsequent load transfer, also using direct current. Third was load transfer using alternating current for operation and control.

Discussion of these papers was principally on the point of complication of relaying necessary for the various methods described. It was the consensus that much remains to be done in this direction.

Most discussion of the session centered around the remarks of George VanAntwerp (Philadelphia Electric) on the subject of circuit switching by remote control.

According to Mr. VanAntwerp, remote control is practical, but it requires individual case application and it is expensive.

The need for such control must be great enough to justify its cost and there is open a large opportunity for better understanding of its problems and for development of equipment and devices to meet them. All of the methods of control, space radio, carrier current, pilot wires, whatever they may be, have their advantages and deficiencies and the ultimate solution of any problem rests on cost in relation to the circumstances of the particular situation.

Concluding discussion of the meeting revolved around installation of air break swtiches and opening them under load. Mr. Rich said that the switches referred to in his and Mr. Kirwen's paper were of higher voltage rating than the lines on which they are installed and that their elements are spaced more widely than is customary for the potential handled. As to breaking load current, Mr. VanAntwerp instanced opening of 33-kv. circuits carrying as high as 90 amp.

Protective Devices

Application Ratings of Indoor Power Circuit Breakers. O. B. Vikoren, Philadelphia Elec.

Investment saved by rating breakers on temperature basis and establishing service factors for both silver and copper contacts. Remedial measures discussed. Many breakers incapable of carrying rated current at safe temperatures.

Performance Criteria for Current Limiting Power Fuses—I. C. L. Schuck, General Electric; **—II. E. W. Boehne,** General Electric.

The pair establish the variables affecting performance, recommend laboratory tests and then apply linear circuit theory to resolve the disparity between field and laboratory results.

Philosophy of Relaying. E. W. Knapp and B. C. Hicks, both Shawinigan.

Basic principles underlying present Shawinigan practice. Dry fuses preferred. Automatic grounding switches used. Through-type C.T. preferred. Impedance and directional for lines, with pilot and carrier for instantaneous.

Simplicity in Protective Relaying. L. F. Hunt, So. Calif. Edison.

Record of 99 percent performance cited in support of program avoiding complexity because aimed at dominant sources of faults. History of the pioneering and philosophy.

Increases in the costs of equipment and labor make it more essential than ever to determine maximum safe loads, in the opinion of Herman Halperin, Commonwealth Edison. The approach that has been used for 20 years in cable ratings can result in substantial increases in breaker ratings, he said, but he called attention to the operating practices that must be included in considering breaker ratings.

R. C. Van Sickle, Westinghouse, suggested that temperatures of conductors through insulating bushings should be checked also, and further that other parts than just the contacts may become overheated. He noted that the paper refers to difference in age of breakers rather than the period of design and cautioned against any conclusion that new apparatus has a better allowance for application beyond its rating.

H. H. Fahnoe, Westinghouse, agreed with the conclusions of the papers on power fuses and suggested emphasis on the need for high power testing laboratory equipment for fuse tests. Full control over all factors is essential and this is usually not possible in field testing.

Power Transmission

Coordination of Insulation and Spacing of Transmission Line Conductors. W. W. Lewis, General Electric.

Tabulated practice being found an inadequate guide, the paper sets up criteria for choice of number of insulator units and spacings to achieve coordination of impulse values.

The Electrical Performance of Ceramic Dielectrics at Elevated Temperature. H. A. Frey and J. A. Jesatko, both Locke Insulator.

Resistivity of porcelain, glass, steatite and zircon tested up to 900 F. shows consistent reduction at high temperatures. Porcelain seldom withstood 400 F. (a tube 500 F.) and 10-20 volts per mil.

The Preservative Treatment of Various Species Proposed for Poles and Crossarms. J. D. MacLean, Forest Prod. Lab.

Recommends treatments for the new timbers proposed in view of the current shortage of SYP and WRC along with a shortage of creosotes.

Carrier Supervisory Control of Pumping Station over Power Cable. W. A. Derr and W. A. Keller, both Westinghouse, and H. A. W. Hedke, U. S. Sugar.

Four million gallons per day for sweet potato starch plant. Carrier for control at 45-165 kc. over 7 miles of 4-kv. power cable (four of which is submarine). Standard 2.3-kv. capacitors for coupling.

Six Years' Experience with Factory-Built Unit-Type Substations. E. F. Miller and R. B. Miller, both Iowa-Illinois Gas & Elec.

Two 4-kv. primary networks. Substation maintenance slight. Transformer 3,000/3,900 kva. with four feeders (a breaker each). Provisions for future expansion excellent.

Cautioning against use of general averages for final design of transmission lines, M. S. Oldacre (Commonwealth Edison) called attention to many local conditions as fog, dirt, sleet and storms which must be given additional consideration. A. Tilles (Pacific Gas & Electric) also pointed to local conditions but feels that the assembly of data by Lewis should prove valuable for comparison of final design with general practice.

Wet flashover is an arbitrary yardstick and should be used with care in the design, in the opinion of H. A. Frey (Locke Insulator). Purpose of his summary is to call attention to lower limits in design and to serve as an estimating guide, Lewis said in closing.

Failure of porcelain shafts in a boiler precipitator and later installation of the new ceramic material for this use has confirmed the laboratory findings, reported C. M. Sherer (Pennsylvania Water and Power Co.). Their previous breakages in a few days were thought to be mechanical and then electrical, and the new shafts have been in service up to one year, without failure, he said. J. J. Torok (Corning Glass Works) presented some data confirming and extending the authors' curves.

Selection of the 3,000 kva. ratings for unit type substations is best in economic comparison, in the opinion of O. B. Falls (General Electric). He pointed to the further advantage of unit substations in holding down the interrupting duty of breakers. Elimination of transfer buses and simplicity with the breaker design used by the authors gave a good overall arrangement, said P. R. Pierson (Westinghouse).

Synchronous Condensers

Automatic Control of Large Synchronous Condensers. M. J. Brown, Westinghouse.

Details of equipment and procedure for starting (either with induction motor or by low voltage) synchronous condensers of 5,000 kva. and larger. Push button for operation by direct or supervisory control.

The basic load kilovar requirements of a system, said J. W. Butler (General Electric), generally can be supplied most economically by capacitors. The capacitor's reliability, cost and flexibility have resulted in one of the most economical tools now available to the system planner and its availability because of present favorable manufacturing conditions makes it attractive even on a temporary basis where a synchronous condenser may be used later. Capacitors are generally justified in the system design and operation pattern in such quantities as to require switching. The cost of switching capacitor banks is so small it is not a deterrent or a controlling factor in an economic analysis. The main consideration is the ability of the system to accommodate the stepped control of the capacitor bank as contrasted with the fine control possible with a synchronous condenser and the problem of switching capacitors is not at all a difficult one, according to T. W. Schroeder (United Light & Railways Service). Oil blast breakers may be 15 kv. in an amount up to 10,000 kva. per breaker without modification of the breaker contacts if it is desired to handle more than 10,000 kva. It may be desirable to insert resistance across the breaker contacts as is done in modern high-voltage breakers. Breakers of the magne-blast type are not limited as to kva. that may be interrupted without production of high restriking voltages. Tests indicate that more kva. than the breaker's continuous current rating can be satisfactorily interrupted in capacitor switching.

Transient inrush currents encountered in energizing capacitors are not harmful to breakers.

There is no end to the ways in which capacitors can be switched or rather to the ways in which their kilovars can be added and subtracted to and from the system; at least one got that impression from the number of circuit diagrams shown by W. H. Cuttino (Westinghouse) for connection of capacitors. Kvar can be controlled by voltage variation accomplished by a step or an induction regulator. These means cost more than switches, but for particular requirements they may be preferable. Capacitors are useful for extending the ranges of voltage regulators, cutting in at maximum boost and cutting out at maximum buck. The greatest usefulness of capacitors can only be attained by the employment of means automatically to vary their inclusion in the system.

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Titanium Compounds As Dielectrics

From a paper by Eugene Wainer before the Electrochemical Society, Birmingham, Ala., April 11-13, 1946.

THREE CLASSES of titania ceramics for electrical use are (1) compositions with high titania content as rutile; (2) those with titania in crystalline form other than rutile; (3) those in which at least a minute portion of the titania is in a reduced state.

Commercially pure titania (rutile) has the following characteristics:

Dielectric constant at frequencies from power range to high radio values	100–110
Power factor at 60 cycles	5 to 7 x 10^{-3}
Power factor at 10^6 cycles	4 to 7 x 10^{-4}
Resistivity at room temperature, ohm-cm.	10^{13}–10^{14}
Breakdown potential, ordinary, a.c. volts per mil	150
Breakdown potential on test pieces designed to resist corona, a.c. volts per mil	600–700

Very pure titania has considerably higher characteristics.

Additions to rutile produce different electrical properties and incorporate desirable ceramic working properties. Good ceramic substitutes for mica may consist of titanium dioxide plus a small amount of titanates of barium, strontium, calcium, magnesium, beryllium and lead. Such oxides as those of aluminum, zirconium, tin and some rare earth metals will increase the refractoriness.

Electrical properties of some titanate compositions are so unusual that their scope is difficult to comprehend. Dielectric constants in a range from 18 to at least 20,000 and possibly more can be obtained, power factors from less than 0.01 percent to 50 percent at radio frequencies, resistances from 10^8 ohm-cm. to 10^{15} ohm-cm., breakdown potentials from 50 volts per mil to 300 volts per mil are available. These properties are so unusual that profound changes may be expected in the capacitor industry.

Surface resistance of reduced titania drops precipitously when illuminated with visible light. If titania bodies are thin enough to be translucent there is evidence that the volume resistance drops likewise; light-dark ratios of 20 to 1 have been obtained. Response appears to be practically instantaneous.

Transient Heating of Rooms

From an article in "Electrical Review," London, March 15, 1946.

LAPSE of time between switching on a heating appliance and the appearance of a sensation of warmth is dealt with at length in Technical Report Ref. Y/T5 of the British Electrical and Allied Industries Research Association. The conclusion from an investigation is that the effective reflectivity temperature rise of an occupant above the wall temperature tends to be proportional to $1/(1 - R)$, where R is the reflectivity; the effect is not appreciable until the measured reflectivity exceeds 0.5 and an increase of 0.5 to 0.6 is needed for noticeable improvement.

It is concluded that a highly reflecting surface is worth while only with low thermal resistivity coverings such as plaster. Best results are obtained with a wall covering with high thermal resistivity and low specific heat, but thick enough to prevent heat escaping into the base material for the time involved.

Status of the Gas Turbine

From a paper by L. N. Rowley and B. G. A. Skrotzki ("Power") before the Midwest Power Conference, Chicago, April 4, 1946.

TODAY the gas turbine is firmly established for supercharging internal combustion engines, pressurized boiler furnaces, and chemical processes. It has a definite place in military aircraft and probably in commercial aircraft. Developments are under way in the railroad, marine and stationary fields.

Maximum efficiency requires efficient compression and expansion of the working fluid. Efficiency can be increased by (1) raising turbine inlet temperature; (2) regeneration; (3) intercooling or reheating; (4) improving efficiency of individual components. The first is simplest; regeneration, intercooling and reheat involve greater complexity and cost.

For locomotives the status of regeneration is unsettled. The only working gas turbine locomotive employs a regenerator to reach full-load efficiency of 16 percent and maximum of 18 percent, operating at the top temperature of 1,070 deg. F. An American design for 1,200 deg. with regeneration shows 20 percent efficiency. Another unit operating at 1,350 deg. is expected to reach 23 percent without regeneration. For power generation the investment justified for higher efficiency depends largely on load factor and fuel cost.

The open cycle offers advantages of lightness, compactness, flexibility and relatively high efficiencies. Internal firing limits it to ash-free fuels, and it also faces a size limitation. The closed cycle offers a means of overcoming these limitations. Decrease in size and weight of turbine, compressor, heat exchanger and piping results in lower cost for these parts at the expense of adding an air heater and precooler. Economic possibilities seem to depend largely on air heater cost.

High-Frequency Heating of Rubber

From an article in "The Electrician," London, February 8, 1946.

HIGH-FREQUENCY HEATING has been extended to rubber technology for production of sponge rubber and vulcanization. Rubber cables are being vulcanized by the British Insulated Cables, Ltd. A cylindrical coil surrounds the rubber to be vulcanized, and is supplied with an alternating voltage at from 100 to 200 megacycles, inducing a high-frequency magnetic field in the rubber. A succession of coils is generally used.

At a lower frequency range, 25 to 30 megacycles, heating is used in the continuous production of cables insulated with polyvinyl chloride and also to repair cables of the same type.

Electronic Control For Tool Drives

From a paper by B. T. Anderson (Sundstrand Machine Tool Co.) at the Westinghouse Machine Tool Forum, Pittsburgh, April 9-10, 1946.

PRODUCTION INCREASES with electronically controlled adjustable-speed motor drives for lathes and milling machines may be up to 48 percent. Four illustrations are given:

1. Grooving an end plate for a cartridge reel requiring repeated cuts is done with an electronically controlled adjustable-speed motor. By pushing a button the machine goes through as many cycles as required and then stops automatically. Two machines produce 10 pieces per hour as compared with 1½ from the original milling machine or 6.7 from two-speed motor drive. The variable-speed drive with electronic control costs 10 percent more, but production is increased 48 percent.

2. An internal clearance radius in a propeller barrel formerly was milled. An automatic lathe with special front carriage and radius turning attachment and automatic speed control increased production 30 percent.

3. Milling the "faying" surface on a steel propeller barrel required special control to meet the tolerances and provide for machining the steel and a mating surface on an aluminum part.

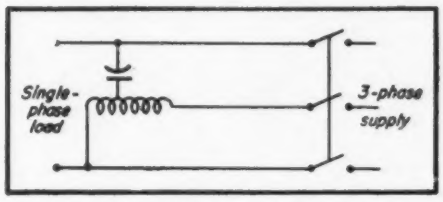
4. To mill the circular, partial and dome fins on forged aluminum cylinder heads for airplane engines a special machine was designed. All fins are machined in two operations against four in the old setup. The operator loads the work, pushes the "cycle start" button, and the machine goes through the complete complicated cycle automatically, increasing production 50 percent as compared to constant-speed drive.

Balanced Welding Loads

From a paper by A. Langley Morris before the Institution of Electrical Engineers (British), March 13, 1946.

ELECTRIC WELDING is essentially single phase, and supply from three-phase lines ordinarily involves serious unbalance. The arc welding load has a power factor of 0.3 to 0.4, resistance welding of 0.6 to 0.7; in both the current is interrupted continuously.

A static system of true three-phase to single-phase conversion has been worked out, using a condenser-inductor network as shown in the diagram. Balance is possible at any three-phase power factor between 0.5 and 0.866, the latter giving the most economical equipment. Balance can occur at only one fixed load, but for certain uses this disadvantage is not serious. For certain arc-welding and many resistance-welding sets, balancing at a number of loads is possible by making the condenser bank in sections and providing corresponding taps on the reactor.



CONNECTIONS for baianced three-phase to single-phase conversion

Equations for determining values of the capacitance and inductance are included in an appendix.

Silicones In Machine Insulation

From a paper by G. L. Moses (Westinghouse Electric) before the Midwest Power Conference, Chicago, April 3, 1946.

TESTS have demonstrated that silicone resins, silicone-treated materials, and wound apparatus have an order of thermal endurance at least as great as was at first predicted on the basis of meager tests on a few machines, and far beyond the order of magnitude of life normally accepted as typical of the best Class B insulation. Silicone-insulated machines have been demonstrated to have outstanding moisture resistance, which is maintained under severe accelerated thermal aging tests.

Use of silicone resins in electrical insulation need not represent any radical departure from well established practice; inorganic components have long been available, but the organic bonds, impregnants and surface treatments have limited the thermal endurance of composite insulation containing mica, asbestos and fibrous glass.

Resistance Welders And Power Supply

From a paper by R. B. Giles in the "Journal of the Institution of Electrical Engineers," (British) December, 1945.

DURING THE WAR the resistance welder became firmly incorporated in industry, and supply sources should be available even though it has been looked on as an undesirable load on account of the poor load factor, particularly troublesome in connection with domestic loads. Unless users locate their plants where ample power is available for industrial purposes, restrictive influences will appear. It seems essential that the anticipated peak demand, power factor and voltage tolerance should be fully explored before an installation. A prime necessity is the establishment of a standard specification for welder manufacturers. With improvements that can be made and a satisfactory welder tariff, the future of the load should be comparatively trouble-free.

Russians Building Heavy Equipment

From an article by Ivan Bondarenko in "Electrical Review," London, April 5, 1946.

CONSTRUCTION of advanced power generating equipment is reported at the Stalin works at Leningrad. A steam turbine of new type, designed by the chief engineer, Michael Bushruyet, is to be built for the Stalinogorsk power station which supplies Moscow. Rated at 100,000 kw. at 3,000 rpm., it will take steam at 1,320 psi. and 865 deg. F., compared with 425 psi. and 750 deg. in pre-war designs. The low-pressure cylinders will be welded, reducing the weight by one-third and decreasing machining time by more than half. Some of the blades will be stamped, using 55 percent less stainless steel than in previous designs.

Six of the nine water turbines for the reconstructed Dnieper station will be built at the plant, the other three imported from the United States. The turbine wheels of the Russian sets will be in one piece, with outside diameter 20 ft. and weight 100 tons. Manufacture of uniflow water turbines working at high pressures is also being considered.

Characteristics Of Beryllium

From a paper by Henry C. Kawecki before the Electrochemical Society, Birmingham, Ala., April 11-13, 1946.

PURE BERYLLIUM, a metal of specific gravity 1.83, melts at 1,287 deg. C., high for so light a metal. It is quite hard and brittle, but can be made somewhat ductile by small additions of titanium or zirconium. Hot-rolled in sheet it is 17 times as transparent to x-rays as aluminum. It is being used in several electronic devices.

Various alloys of copper with small amounts of beryllium and other metals have a hardness of 85 to 98 Rockwell B, high tensile strength and electrical conductivity of 50 to 60 percent of copper. One such alloy has a tensile strength of

80,000 psi. annealed and 170,000 psi. when heat treated. A beryllium-nickel alloy has a tensile strength of 270,000 psi. and Brinell hardness of 480.

Reduction of the metal is somewhat difficult, but an alloy with 3.75 to 4.5 percent beryllium can be produced from the ore in the electric furnace.

The beryllium copper alloys are useful for resistance welding electrodes and for current-carrying springs and switch parts.

Britain Adopts 240-Volt Standard

From an article in "The Electrician," February 15, 1946.

FOR LOW-VOLTAGE a.c. supply in Great Britain the standard is to be 240 volts, according to a decision of the Minister of Fuel and Power. One faction desired a band of 230-240 volts, while another pressed for the single standard of 240 volts. Manufacturers made it clear that the real advantage of standardization could be secured only if they were able to make lamps and apparatus for one voltage with the least possible variation. Consideration was then given to standardization at the hitherto recognized value of 230 volts or at a new standard, 240 volts.

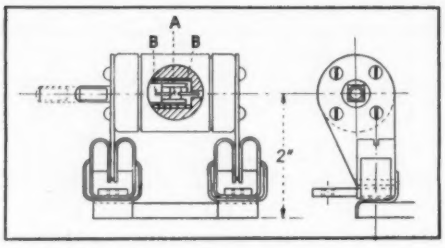
Out of 9,880,000 customers, 5,602,000 are not at 230 volts and 1,270,000 at 240 volts. It was calculated that the cost of adopting the lower figure would be £27,850,000 ($111,400,000) against £22,700,000 ($90,800,000) for the 240-volt standard. The economic objections inherent in a reduction of voltage will be substantially mitigated for the 900,000 customers who now use 250 volts by the adoption of the higher figure, and it will result in an improved value of the existing systems now below 240 volts, as well as an advantage with respect to future capital expenditures on the low-voltage mains.

Fuse Protection For Medium Voltage

From a paper by R. T. Lythall in the "Journal of the Institution of Electrical Engineers," (British), February, 1946.

PROTECTION of medium-voltage circuits against excess current due to earth faults too small to blow the fuses is provided by an "earth fault striker," which is in effect the striker portion of a tripping fuse, calibrated for its protective purpose.

A typical earth-fault striker (see diagram) has no main current elements, and depends on heating rather than fusion. A short heating element, A, of high



EARTH-fault striker

specific resistance, is imbedded between two low-resistance leads, B, in a small chemical charge whose temperature setting is such that the striker acts at definite current values within definite time limits. An inverse time-current characteristic may be obtained.

The present stage of development indicates that instantaneous tripping values of 7½ percent earth leakage can be obtained. Tests have shown that in the spill circuit of a current transformer a current of 0.1 to 1.25 amp. is necessary.

This earth-fault striker also can protect against open circuits, using three single-phase voltage transformers with their secondaries in open delta, the strikers being connected across the opened points.

Rotating Arc Furnace

From a paper by Tonnes Ellefsen before the Electrochemical Society, Birmingham, Ala., April 11-13, 1946.

ELECTRIC melting furnaces, particularly those for ferroalloys, are subject to the formation of craters around the electrodes due to sintering of the charge. These result in loss of efficiency, violent escape of gases and sometimes loss of charge. Rotation of the furnace with respect to the electrodes has been found effective in preventing this trouble. Elkem furnaces have been built in Norway with capacities as high as 8,000 kw. and with weights as high as 600 to 700 tons on a turntable.

Speed of rotation is very low, a revolution in 6 to 96 hours. With a three-phase furnace a movement of 120 deg. serves to obtain a complete movement of the electrodes, which may be reversed if desired. Since the speed is so slow a very small motor provides sufficient power.

Results of six months' operation of one furnace show 17 percent larger production than for a stationary furnace with the same power and consumption of about 10 percent less ferrosilicon per ton. Direct savings of about 100,000 kroner ($21,000) and profit on increased production of 15,000 kroner ($3,150) are shown. The cost of the furnace is about 8 percent more than for an ordinary one of equal capacity.

Rapid Reversing Drives

From a paper by R. H. Clark (Warner & Swasey) at the Westinghouse Machine Tool Forum, Pittsburgh, April 9-10, 1946.

RAPID reversing motors can be justified by the need for one or more of the inherent features of this type: (1) high starting torque for fast acceleration; (2) high reversing torque for fast and accurate plug stops and reversals; (3) ability to operate under severe duty cycles without overheating and with small maintenance. Motors of this type are not used more because they are special and expensive, and often machine production is limited by reversal capacity.

Much development work by machine builder and motor manufacturer is needed before a successful machine is produced. The electrical manufacturer can do much by clearing away some of the air of mystery which surrounds the engineering theory involved. Data should be published on rotor inertia, reversal capacity, starting currents and torques, plugging currents and torques; and, for multi-speed motors, information on the interrelation between starts, plug stops, speed changes and reversals for various speeds. The machine tool builder must furnish accurate data on the machine inertia duty cycle on which to base motor design.

Machine tool builders are not satisfied with the job which the electrical industry, on the whole, is doing on rapid reversing motors, and is anxious to get better designs and more information.

Ball Lightning

From an article by E. A. Logan in "Electrical Review," London, March 8, 1946.

FIREBALLS or ball lightning are widely known, although seldom seen by trained observers. It is agreed that they are round, that they travel rather slowly over the ground or into rooms of buildings, and that they may disintegrate spontaneously and explosively. The size is reported from that of a pea to a matter of yards.

One explanation is that the fireball is similar to a vortex ring, consisting of highly charged particles of matter moving rapidly and creating a strong magnetic field. Under certain conditions the weight would be about the same as that of the atmosphere and they might be moved about erratically by air currents. The impact of a violent blow causing internal disruption of balanced orbits would conceivably cause total disintegration and explosive release of the large amount of stored energy. It is suggested

that they are a byproduct of a cloud-to-ground stroke of lightning.

Standardization For British Transformers

From a paper by A. G. Ellis before the Institution of Electrical Engineers (British).

SOME MEANS of standardization of the transformer industry would benefit both user and manufacturer. However, standardization of supply is a necessary precursor to dimensional or design standardization. External dimensions of distribution and medium-size power transformers of the same rating could then be made interchangeable.

Standardization of principal fittings, particularly fixings and main dimensions of terminal bushings and cable sealing boxes, should be possible and desirable. Standardization of internal dimensions and internal components would be difficult to achieve at present, while detail design standardization is neither necessary nor feasible now.

Suggestions are made for standardization of fundamental dimensions to effect interchangeability of transformers of different makes without necessitating modification of detail design and manufacturing techniques.

Permeability At High Frequencies

From a paper by J. T. Allanson in the "Journal of the Institution of Electrical Engineers," (British), December, 1945.

DECREASE of magnetic permeability with increase in frequency of the applied field up to 10^{11} cycles per sec. is principally due to the eddy-current braking which occurs as the domains change their magnetization. There is a further possibility that at much higher frequencies the ferromagnetic properties may disappear in thin layers of the material.

Permeability measurements at high frequencies can be derived only from measurements of the electromagnetic properties of ferromagnetic materials. These measurements fall into two categories: (a) wave absorption, attenuation or resistance; (b) wave velocity, wave reflection or inductance.

There is room for future experimental work on the subject, as absence of adequate data and use of indefinite materials in much of the work reported to date renders correlation of results almost hopeless.

Machine Tool Vibration Reduced

From a paper by Rolland C. Griffith (Heald Machine Co.) at the Westinghouse Machine Tool Forum, Pittsburgh, April 9-10, 1946.

CHATTER MARKS on finely finished surfaces may be due to forced vibrations initiated by sources of power, such as electric motors. The best solution is to do away with the cause. Induction motors have three major sources of pulsation. Rotational unbalance is easily corrected, and precision bearings reduce ball-bearing vibration to an acceptable value. The rotating magnetic field may require special treatment. Investigation showed that a symmetrical mounting about the bearings reduced the magnetic vibration in the ratio of 13 to 1.

In an electric circuit transmitting direct current with one or more a.c. components, wave traps can be used to smooth the voltage. Outboard motors have been used where the machine tool and the motor can be mounted independently on a relatively immovable floor. It is evident that only a massive floor should be used as a base in such an installation.

Fault Location in Cables

From a paper by F. F. Roberts before the Institution of Electrical Engineers (British).

NORMAL fault location procedures are sometimes impracticable, either for technical reasons or on account of loss of service time. If clearance of the fault is not urgent, occasionally it is allowed to remain. This is particularly true of intermittent faults lasting only fractions of a second, as in coaxial cables when soldered joints break loose, or in power cables which experience partial dielectric breakdown.

Two types of radiolocation are possible. One consists of repeated short bursts of a fixed carrier frequency (pulse transmission), the other a regular cycle of frequency variations of a constant-amplitude carrier. With pulse transmission the time delay of waves reflected from the fault gives a measure of the distance, while in the frequency modulation method the beat frequency produced by mixing the transmitted wave with the reflected wave is the measure.

Field trials of an instrument using the pulse method have shown that a 5-ohm series fault and a 1,000-ohm shunt fault could be detected in a 0.375-in. coaxial cable at 10 miles with an equivalent error of 160 yd. With corrections this error could be reduced to 32 yd. from each end of a 7½-mile repeater section.

A cathode ray oscilloscope may be arranged to give a photographic record from which to locate the fault.

Locating Cable Faults

From a paper by J. H. Savage in the "Journal of the Institution of Electrical Engineers" (British), December, 1945.

IMPROVEMENT in the loop fall-of-potential method for locating core-to-sheath faults in cables has been made by reversal of the usual connection. A high-resistance voltmeter is connected at the end of the cable between the core and the sheath, and a battery is connected between two points on the sheath fairly close together. Between the negative battery contact and the voltmeter the sheath is negative with respect to the center of the battery, while between the positive battery contact and the open end of the cable, and also through the fault, the conductor is positive, causing a deflection on the voltmeter. If the battery contacts are moved beyond the fault the potential difference at the voltmeter disappears. Then by transferring the voltmeter from one end of the cable to the other the exact location of the fault can be obtained.

A d.c. "valve" voltmeter of high sensitivity with resistance in the order of 2.5 megohms is essential to the success of the method, which is of particular value for factory tests.

Motors For Reversing Service

From a paper by E. Y. Seborg (Barnes Drill Co.) at the Westinghouse Machine Tool Forum, Pittsburgh, April 9-10, 1946.

DRIVE for certain special-duty cycles may be done with standard motors by the use of forced air cooling. An example is the use of a squirrel-cage motor for indexing and clamping a rotary table against a positive stop. Drive is by a worm with locking angle, with a clutch mechanism with a rap clutch. The time cycle is: run forward 3 sec., run reverse for 1 sec., stop for 6 sec., then repeat. On account of short delivery a standard motor was installed. The mechanical performance was good, but after four hours the motor temperature exceeded the safe limit. A rewound motor with greater torque also overheated. The drive problem was solved by fitting the original motor with a separate motor-driven blower to force air through it.

Existence of such problems suggests that a line of end bells should be designed with an opening for a separate small motor-driven blower which could be supported by the duct. This would give an improved appearance and facilitate replacement in the field.

EDITORIALS

S. B. WILLIAMS, *Editor*

Time for Action on Heat Pump Program

REVISED specifications for a heat pump for year around house heating and air conditioning are now being prepared for approval by power companies that have an interest and might be expected to join in the purchase of a number large enough not only to give an adequate field test of the device under diverse conditions, but also to permit the manufacturers to devote a reasonable amount of time and money to the development of a satisfactory unit.

Initially 1,000 house heating units were suggested as the goal to shoot at in the original pooled orders. Since it would be desirable to have all three natural heat sources—air, water and the ground—represented in the initial field trials, it is obvious that if more than one manufacturer is to participate in the order, the number of units cannot be reduced much below the figure originally set without running into high costs. If participating utilities are liberal in their commitments, they will be rewarded ultimately with data from a field sample that is adequate and at a cost that is not too great.

There is need for decisions to be made fairly promptly because even after the contracts are let it will take the better part of a year, or perhaps an even longer time, for the manufacturers to start deliveries. It would also be desirable for the program to get under way before too large a part of the new building market has passed by. Added emphasis is given to the need for prompt action by the fact that adequate operating data cannot be obtained in less than one full heating season.

A concurrent program for a water heater pump involving some 10,000 units is also being set up, but because the problem is not so difficult, less time before deliveries can start will be needed. It is conceivable that a water heater pump could act as the advance agent for the house heating job, for by demonstrating the practicability and low operating cost of the heat pump it would serve to establish acceptance for what will be a difficult thing for the public to understand in the beginning.

While pooling of orders will contribute greatly to keeping first cost down, those who enter this program must be prepared to make a sizable investment. This should not deter any progressive management, because the market is so tempting. If initial cost of units is greater than the user is willing to invest, the utilities should be prepared to subsidize the installations in the beginning. A special department and trained service personnel should be considered. And, of course, allowance must be made for the cost of gathering performance data and compiling them.

A program such as this reminds us of the suggestion made in these columns less than three years ago, that the industry set up a load behavior research program. Ideas for new load-building devices are constantly popping up. If they seem to have merit there should be some way of finding out in an orderly manner. Perhaps this heat pump program might also serve to try out this idea as well. It would at least have the advantage of setting up a uniform method for obtaining test data and interpreting the results.

While this is not the first time that utility companies have embarked on joint load development programs, it gives promise of being the largest. Although it is a bold program, it is bound to succeed if only it has back of it enough men of enthusiasm and vision.

Reserves Based on Probability Calculations

GOOD annual load factor admittedly favors getting better performance out of all system facilities. That is the whyfor of the drives for valley-filling loads. But whether the valleys get filled automatically or as a consequence of promotional effort the result is the same for the system planning engineer who is charged with provision of adequate reserve facilities at all points on the system. He finds fewer and shorter periods during the day, week or year when he can count on releasing a machine for routine inspection and overhaul. More and more he is verging toward the situation in which he may have to provide reserve capacity more to take care of maintenance than to afford backup in case of system failure. Maintenance is a recurrent and regular event whereas faults are spasmodic happenstances.

The two are inextricably wrapped up together, however, and that is why some computations on the likelihood of accidental outage at any particular time need be made to determine how much of the reserve can be scheduled with safety for routine maintenance at any logical period.

Theory of probability is something to which practically every graduate engineer was "exposed" in his mathematics course. It does tell you what you can expect in poker or bridge and that is as far as the interest of most engineering students ran. Here, however, in this matter of system reserves is an issue in which a competent calculation based on

mathematical certainty can mean dollars saved or dollars needlessly invested.

If management thinks it has a mathematical "nut" who is much too prone to play around with matrices and tensors they would do well to encourage him to swing over to application of the theory of probability. He will relish the thrill in determining what is the risk of simultaneous failure of several of the largest units on a large interconnection and what, therefore, the reserves need to be. If loss greater than reserves is going to happen only once in 17,000 or even once in 65 years, why worry? Yet if the cards show once in 15 years, maybe the reserves need to be enlarged. Then a look at the load curve will tell whether maintenance can safely be done as needed.

Cooling Alternator Rotors with Water

WHEN hydrogen cooling of alternators was proposed it met, just as most other revolutionary proposals, with considerable adverse argument and plenty of reluctance. It would be difficult to keep the system tight, critics said, there would be explosions, it would not be worth-while economically, etc. But now the practice is standard for the larger and high-speed machines.

Serious suggestion has just been made by Carl Fechheimer that the problem of uniform cooling of large rotors can be met practicably by passing water below and between the bar slots where the temperature differentials have caused trouble because gas cooling is not ideal. Then to complete the radicalness of the departure he suggests using Pyranol to cool the stator windings and hydrogen to do the same for the end turns of the rotor.

Reaction to this novel procedure has already shown respectful skepticism. That there are difficulties is acknowledged but who would dare say now that in time the details cannot be worked out? When and if it can be achieved, liquid cooling seems to promise a gain of approximately 25 percent in output per pound of alternator and that should be attractive enough to encourage experimentation.

Growth in Engineering Society Membership

MEMBERSHIP in the American Institute of Electrical Engineers is now over 25,000, reflecting a growth in the past two years of more than 17 percent. A similar condition is noted in the membership increase of the Illuminating Engineering Society, which this year will reach 5,000, or 25 percent more than two years ago.

In looking for a reason for such substantial growth, a comparison was made with the increase in circulation of engineering publications and there apparently was the answer. For instance, since paper restrictions were removed last year, the number of subscribers to ELECTRICAL WORLD has gone up 17 percent, and with the expenditure of less sales effort than before the war. This is not unusual; other engineering publications have had a similar experience. A further reflection of conditions is found in the sale of engineering books which it is conservatively estimated is 25 percent ahead of last year.

In other words, the rate of increase of membership in engineering societies is but symptomatic of the great thirst for information. During the last few years large numbers of engineers were not engaged in their normal pursuits. In coming back they frequently have found a new set of conditions or that they were rusty or not up to date. That is why they are buying books, subscribing to technical magazines, joining engineering societies.

Society administrators must recognize this situation and realize that this enlarged membership will not stick just for prestige value. These new members are not joining in order that these societies may be bigger or more influential. They are looking for help.

Where, Oh Where Are the New Products?

WHERE is the flood of new products and new designs that everyone was expecting? Will there be a flood later? It is nearly a year since V-J day and more than a year since V-E day, yet while the number of items coming to our attention is increasing there still aren't very many new things coming on the market.

While we have been reminded that most electrical manufacturers were busy day and night during the war working for the government, we cannot believe that developmental work was entirely passed by during all that time. A much more appealing justification from this condition would be the decision not to bring out anything new while deliveries were so bad. Obviously a producer does not want to subject the acceptance of a new design to an uncertain raw material supply or to the delays caused by an already jammed-up production schedule.

It is possible also that the confusion of OPA regulations has caused some manufacturers to withhold announcements until price ceiling regulations no longer applied to them or to the particular product. In the light of things that have happened, one cannot blame them for taking such precautions.

To launch a new product isn't a simple thing, particularly for a small manufacturer. A mistake in timing can be expensive not only in current sales, but in future sales as well, because if a thing doesn't go over when it is new it is more difficult to get acceptance later. Nevertheless, buyers are eager to see what is new, and if there was some indication of something real new coming they might not contribute to the present market pressure but wait. If enough of that spirit could be created to bring orderliness to the market at an early date it might be very much worth-while.

WASHINGTON COMMENT

By R. N. LARKIN Washington Correspondent

The Issue of Steam Stand-by

JUST about everybody in the private power business who ever had any dealings with him—and who hadn't—was interested when President Truman selected J. A. Krug to replace Harold L. Ickes as Secretary of Interior.

What made Krug's advent so appealing to the private power business was, beyond much question, his war-time power record. But no one from private power who ever did business with Krug could have been foolish enough to believe that his tenure in Interior would disestablish the devotion to public ownership which exists in the Department, or that it would signal a policy of deference to private power.

A topic has arisen, however, on which Interior and private power should, in the public interest, do business, namely steam stand-by capacity for federal hydro projects.

Interior construed Section 5 of the Flood Control Act of 1944 to mean that, where necessary, it could construct or acquire steam-electric plants to back up the hydro systems of War Department dams, whose energy Interior markets under Section 5.

No Enabling Law

Senate debate on the 1947 Interior Appropriation bill makes it unmistakable that such interpretation of Section 5 was erroneous. Sen. John Overton, sponsor of Section 5, insists that it does not authorize steam capacity. Sen. Carl Hayden, Interior's strongest supporter in the upper house, concedes the same with the words:

". . . I am quite sure that it is the unanimous opinion of the committee that at the present time there is no adequate authority of law for building steam plants to firm up the power at government dams."

Nevertheless, one Interior system, according to Hayden, that in California's Central Valley, has steam capacity authorized. Also, it is clear that Interior itself will soon seek some legal authorization to provide necessary steam capacity. One need only read several laws or volumes of testimony before Congressional committees on power legislation to be certain that Congress insists on the widest possible use of electricity, and adequate return from its sale. Moreover, it is unthinkable that the industry wants to see millions of kilowatts of hydro left to its own resources, however completely it disagrees with the principle of federal construction of auxiliary steam capacity.

It would seem that the time has come for private power to determine completely and specifically what it can and cannot do in this regard and then take its proposition to Krug. Obviously, an offer to buy all the energy at a given dam would be unacceptable. Congress specifically refused an even more tempting policy when it rejected the Bailey amendment to the Flood Control Act and adopted Section 5.

Reasons for Policy

Numerous reasons exist why private power should determine a policy to provide the steam back-up necessary to federal projects.

One of the most damning indictments which public power Congressmen hurl at the industry is that it has done nothing to meet this or that need, and that when it has done something, that something is just unacceptable to the political body which Congress inescapably is and must be. The industry could avoid future indictment on this by doing something acceptable now.

Another reason is that is would be concrete evidence that the industry now wants peace rather than conflict with the Interior Department. Interior is now headed by a public power man who, when he had the opportunity to hit private ownership hard, risked his federal career to insist that it be treated with scrupulous fairness. Granted that the proper conduct of the job he then held required him to do so, the proper conduct of his new job does not require J. A. Krug to play it down the middle. Rather, it requires him to favor public ownership. This he can do in the fashion of a Harold Ickes or in a non-vindictive way which recognizes the existence of opposing interests and seeks to make the best deal possible for each in the public interest. There is no attempt at appeasement nor at currying favor implicit in an honest offer to do what can be done to help solve a real problem.

Cooperation Has a Chance

It should be realized that, whatever the industry does or does not do in this connection, Congress will be adequately, if not precisely, informed. Congress doesn't want to vote money for steam plants, nor does it particularly want to authorize any. It does not want to hammer out and vote upon a clean-cut, definitive choice as between public ownership or private ownership. It realizes that the private utilities do have steam capacity which could firm federal hydro in most places where the latter may be installed. It wishes to heaven that it could avoid future repetitions of the SPA, the Central Valley and all the other specific fights which are bound to come up as new projects start generating.

This is an unusual and even a heady situation for private ownership to be in on Capitol Hill. If it were to present a proposition to use private steam for federal hydro which makes sense to Congress, it would have an excellent chance to win its point. Such a proposition, however, would have to be one which would satisfy those who want wide distribution of energy. It would have to contribute to the assurance of revenues adequate to repay the power costs of the hydro projects. It would have to be acceptable to a Congress which has demonstrated beyond question that it is not in the least afraid of public ownership, one which, indeed, is inclined to think that a little public ownership is a good thing. It should be applicable all over the nation, not just regionally.

It would, in the last analysis, have to satisfy the average member—who is a pretty moderate man—that it is reasonably in line with the existing desire of Congress—that as much power as possible be made as widely available as possible at as decent a rate as possible.

NEWS OF THE WEEK

Engineering Unity Urged for Solution of Problems

President Wickenden of A.I.E.E. Sees Engineers as Hope of Industry Sorely in Need of Leaders—Institute Convention at Detroit Attracts 1,200

UNITY of engineering effort in solving the complex problems of modern industrial developments was urged upon the 1,200 engineers attending the 61st annual summer convention of the American Institute of Electrical Engineers last week in Detroit.

As a part of the five-day program, 76 papers were presented giving expression to the progress in engineering fields. Many of these papers of interest to those in the utility field are abstracted elsewhere in this issue, the abstracts being followed by the discussion on the papers by those at the sessions.

"Industry is sorely in need of leaders who can bring conciliation from within. I believe the hope of finding such leadership lies in the essential quality of trusteeship which is embodied in professional life and service. Among the professions, engineering has a unique contribution to make. Only as we entrust leadership in industry more fully to professional men who acknowledge their responsibility to investors, workers, customers, and the public alike, and whose highest aim is to reconcile and unify these interests for the common good, can we hope to find some path out of the crippling strife on to the plains of peace."

President W. E. Wickenden threw this challenge to the engineers, adding that he believed the engineer has marked advantages in meeting it. His position is a natural bridge between mechanical and commercial skills. He must speed the advances of research and the improvement of machines and processes which alone will enable industry to meet its obligations to labor and still earn the profit necessary for survival.

Emphasizing the goals of engineering development, Mr. Wickenden, who is also president of Case School of Applied Science, said that modern progress depends on organized efforts of many men rather than individual scientific genius. Production is the alternative to chaos, and technical progress is the key to increasing production. But, he warned, it is not in the general interest that labor or any other one group should receive the entire fruit of scientific advance and technological gain.

David C. Prince, vice-president, General Electric Co. was presented with the Lamme medal for 1945 (ELECTRICAL WORLD, June 15, Page 8) for his "distinguished work in the development of high-voltage switching equipment and electronic converters."

In his acceptance speech, he urged support of the Baruch report for control of atomic energy development. He pointed to numerous examples of engineering additions to the bases of science, citing the medal quotation that "engineering views hopefully the hitherto unattainable." Fission is another tool of science ready to hand to the engineers, he concluded, and there are many other complex problems waiting for similar approach for solution.

H. E. Strang, General Electric Co., sketched the career of the medalist, and C. M. Laffoon, member of the Lamme Medal Committee, outlined the history of the medal.

J. Elmer Housley, district power manager, Aluminum Co. of America, Alcoa, Tenn., was elected president of the institute. Vice-presidents elected were Ernest W. Davis, chief electrical engineer, Simplex Wire & Cable Co., Cambridge, Mass.; O. E. Buckley, president, Bell Telephone Laboratories, Inc., New York; Titus G. LeClair, chief staff engineer, Commonwealth Edison Co., Chicago; R. F. Danner, general superintendent, Oklahoma Gas & Electric Co., Oklahoma City; and Charles F. Terrell, vice-president, Puget Sound Power & Light Co., Seattle. Walter I. Slichter, Schenectady, N. Y., was reelected treasurer.

Directors elected were James F. Fairman, vice-president in charge of produc-

OFFICERS AND MEDALIST—J. Elmer Housley, left, president-elect of the American Institute of Electrical Engineers; President W. E. Wickenden, and David C. Prince, 1945 Lamme medalist, at the institute convention in Detroit

A.I.E.E. HONORS WINNERS—G. D. McCann, Westinghouse Electric Corp.; G. W. Scott, Jr., Armstrong Cork Co; A. Boyajian, General Electric Co.; and J. De Kiep, G. L. Moses, and L. R. Hill, Westinghouse, winners of technical paper awards

tion and operation, Consolidated Edison Co., New York; Raymond T. Henry, chief electrical engineer, Buffalo Niagara Electric Corp., Buffalo; and Earl P. Yerkes, engineer of equipment and buildings, Eastern Area, Bell Telephone Co. of Pennsylvania, Philadelphia.

Institute prizes for papers were reported by M. D. Hooven, chairman of the Awards Committee. The prize winners were: In the field of engineering practice, J. DeKiep, L. R. Hill, and G. L. Moses, Westinghouse Electric Corp., for a paper entitled, "The Application of Silicone Resins to Insulation for Electrical Machinery." In the field of theory and research, G. D. McCann, C. E. Warren, and H. E. Criner, Westinghouse Electric Corp., for a paper entitled, "Determination of Transient Shaft Torque in Turbine Generators by Means of Electrical-Mechanical Analogy." In the field of public relations and education, A. Boyajian, General Electric Co., for a paper entitled, "Cultural Training of the Engineer." Initial paper, G. W. Scott, Jr., Armstrong Cork Co., Lancaster, Pa., for a paper entitled, "The Role of Frequency in Industrial Dielectric Heating."

•

Portland Adds Utility Tax

The City Council of Portland, Ore., voted recently in favor of an ordinance introduced by Dorothy M. Lee, commissioner of public utilities, that would levy an annual 3 percent occupational tax on electrical utilities. Passage of the ordinance carried an emergency clause to set the measure in effect at once.

It was expected that the new law, which includes a similar tax on steam, water, telephone and telegraph utilities, and a 2 percent levy on gas and transportation, will yield about $400,000 for first fiscal year and $600,000 annually.

Washington Water Power Will Serve 2 Idaho Towns

Pierce and Headquarters, Idaho, are to get electric service provided by the Washington Water Power Co.

The company, under new contracts, will construct 39 miles of transmission lines from Orofino, Idaho, to the two towns. Power will be sold at Pierce to the Pierce Light & Power Co. for distribution to consumers over its lines, and will be served directly to residents and the Potlatch Forests at Headquarters by Washington Water Power. Headquarters is the center of logging activities of Potlatch Forests, Inc.

Both towns are at present served by diesel generating plants, Headquarters' being operated by the lumber company and Pierce's by Pierce Light & Power.

Surveys for the transmission line will be undertaken immediately and construction will begin in August if materials are available.

•

Montana Power Sponsors Scholarships for 4-H Clubs

Sponsored by the Montana Power Co., a program functioning to develop 4-H boys' and girls' ingenuity in contriving improved methods of accomplishing farm and home tasks by electricity has been opened by the Montana State College extension service.

The utility has offered three $100 college scholarships, two local leaders' scholarships in each county that will provide free trips to the Montana 4-H Club Congress at Montana State College in September, county and state demonstration awards, and four county program awards of $50 each, as well as other prizes.

Hartford Mercury Unit Has 80 Percent Availability

Hartford Electric Light Co.'s pioneer commercial mercury boiler and turbo-generating unit, installed at South Meadow Station in 1928, generated 1.6 billion kw.-hr. net to January 1, 1946. In the 151,000 hours from installation to January 1, the mercury unit was in operation 132,000 hours and was down 19,000 hours for major rebuilding of turbine and boiler. Eighty percent availability covers all operations with normal maintenance from all causes for both mercury and steam cycles.

In 1945 the unit produced 27,076,000 kw.-hr. in gross electrical output and delivered the equivalent of 50,276,000 kw.-hr. in steam from the mercury vapor condenser to the station mains. It was operated at a maximum electrical output of 4,000 kw. plus 6,000 kw. in steam energy. In that time the unit delivered 1,246,000 kw.-hr. for its station service equipment. The net total output for the year in electricity and steam equivalent was 76,106,000 kw.-hr. The fuel rate for the year was 0.617 lb. per kw.-hr. on a coal basis and the heat rate 10,921 Btu per kw.-hr. Oil fuel is used. The unit was available 84 percent of the time.

The company is now studying the possibilities of rebuilding the unit or taking advantage of the improvements resulting from experience with the mercury cycle.

•

Congress Votes New Lines

The House and Senate accepted without amendment last week a conference report on the 1947 Interior Appropriation Bill which gave the department substantially all the transmission lines asked for but which gave it less money than had been sought.

Only in the Southwest, where the Southwest Power Administration item was cut by two-thirds, and in California's Central Valley, where a westside transmission line was passed over, did Congress fail to approve transmission lines.

•

Line Extensions Forbidden

Blocking Pacific Power & Light Co. proposed extensions on lines to certain areas near Centerville, Wash., Klickitat County commissioners recently refused to consider the utility's franchise petition. Their grounds were that final steps have not been consummated in a condemnation suit by which the Klickitat Public Utility District is seeking to purchase electrical property in the county owned by P.P. & L.

Montreal Light Stockholders Reject Indemnity Offered by Quebec Hydro

Offer for Physical Assets was Insufficient to Pay Off Mortgage Bonds — Long Arbitration Battle Expected — Rejection of Similar Proposal to 2 Subsidiaries Expected — Properties Show Profit

ANGERED by an offer of only $54,873,500 for the physical assets of Montreal Light, Heat & Power Cons., stockholders who believe they are worth $135,295,663 voted at a recent meeting to reject the offer of the Quebec Hydro-Electric Commission and to take all the necessary legal steps to protect their interests in the long arbitration battle that is expected to follow.

The properties of the company were taken over on April 15, 1944, along with those of two subsidiaries, Montreal Island Power Co. and Beauharnois Light, Heat & Power Co. No action was taken to indemnify the stockholders until late in May, 1945. Then a law was passed authorizing Quebec Hydro to make an offer for the properties. If the offer is rejected, which it has been, a board of arbitration is to determine the value. This award may be revised by the Court of King's Bench, but the decision of this court will be final and without appeal.

In the two years of operation by the Commission, the properties have paid all cost of operation, interest on indebtedness, and have returned a net profit of over $35,000,000 before depreciation, utility officers claim.

Stockholders Must Pay Off Bonds

The offer of the Hydro Commission for each of the three properties included the requirement that the stockholders be required to pay off the mortgage bonds against the properties from residual assets. The result would be that if the offers were accepted: stockholders of Montreal Light would have to add $29,207,500 plus interest since April 15, 1944, to the Commission's offer of $54,873,500 for the physical assets to pay off $84,081,000 in bonds; Island Power stockholders would have to add $1,123,000 plus interest to the offer of $7,942,000 to pay off $9,065,000 in bonds; and Beauharnois stockholders with outstanding bonds of $79,380,000 and no other assets would get nothing out of the $72,260,486 offer. All of the offers include a 10 percent premium as reimbursement for compulsory seizure.

Only Montreal stockholders have voted to reject the offer, but stockholders of the other companies are expected to follow suit.

The physical assets of the Montreal Light covered by the offer are the operating assets used in the generation and distribution of gas and electricity and do not include the investments in bonds or shares of other companies which are still owned by the company. Montreal Light owns 86 percent of the preferred and 91 percent of the common shares of Island Power and 81 percent of the shares of the Beauharnois company. From these and other sources, Montreal Light has been able to secure enough income to pay expenses and pay small dividends.

The offer by hydro is not a purchase buy but only an indemnity to recompense the stockholders for their seized assets. A committee of three stockholders is to be appointed to attempt to get the government to buy the Montreal Light stock. There would be an advantage in this as there is some question as to the taxability of the money collected as indemnity. Purchase of the shares by the government would make the proceeds exempt from taxation as being payment for a taxable asset, it is believed by lawyers.

Company valuations of their own properties including the 10 percent for "forcible taking" are $135,295,663 for Montreal Light; approximately $109,260,486 for Beauharnois, and approximately $11,942,000 for Island Power.

John S. Norris, president of all three utilities, also announced at the meeting that the company will take court action to have L. E. Potvin, chairman of Quebec Hydro, disqualified as one of the three arbitrators. Under the law Quebec Hydro was allowed to appoint one arbitrator and named its own chairman. The utility company objects on the grounds that he cannot possibly be "disinterested."

The other arbitrators are J. Stewart, Halifax attorney, named by the company, and Judge Thomas Tremblay, now chairman of the Rural Electrification Board of the province, who was named by Chief Judge Ferdinand Roy of the Provincial Court.

COOPERATION IN ARKANSAS—To further the post-war development of Arkansas, leaders of both rural cooperatives and business-managed utilities are working together on the Arkansas Economic Council of which T. E. Bostic, left, president of the Arkansas State Rural Electric Cooperative Association, has been elected vice-president, and C. H. Moses, president of the Arkansas Power & Light Co., has been elected president

Hampton, Ark., Acts to Buy Ouachita Co-op Properties

In the first action of its kind in the state, the City of Hampton has asked Arkansas Public Service Commission to fix a price on electric systems of the Ouachita Rural Electric Cooperative at Hampton, Banks and Harrell in order that the city of Hampton might purchase them under its contract with the co-op.

The systems in Hampton and nearby Banks and Harrell were acquired from West Memphis Power & Water Co. in 1942, but the city of Hampton would not approve the sale until it had granted a new franchise which included a provision that Hampton later could acquire the properties from the co-op. At a recent city election Hampton voted to acquire the properties because service from the co-op was not up to standard.

Under Arkansas laws, the Public Service Commission fixes the value of properties where the present owner does not want to sell them. The city of Hampton, in its petition to the commission, said it had been unable to reach an agreement with the co-op on value of the properties.

New P. S. C. Head Named

Edward Wimberly has been elected chairman of the South Carolina Public Service Commission to succeed Dr. George L. Timmons. John C. Coney is the new vice-chairman. One-year terms will begin July 1. Mr. Coney is said to be the "dean" of public service commissioners in the United States; he has served since 1922.

New Orleans Utility Has Big Construction Program

Strict conservation, prevention of waste, salvage and the use of substitutes is enabling New Orleans Public Service Co. to meet its large construction program, handle needed repairs, and keep equipment in operating condition. Difficulty is experienced in obtaining equipment, supplies and repair parts, and shipments of large items of equipment are from six months to a year behind schedule, according to A. B. McCoard, vice-president.

Major items of new work is the construction of the 37,500-kw. Industrial Canal steam-electric station which will be completed next year. A rehabilitation program is now in progress at the Market Street station with work scheduled for completion in 1948. Other items include the new buildings for shops, storerooms and offices, and additional 110-kv. transmission and substation facilities. The construction budget for 1946 is $6,988,041.

Work on a number of projects is progressing as rapidly as supplies and equipment are received. Scheduled to be completed during the year include: increasing capacity of a.c. underground network system, additional 13.2-kv. feeder for underground network, additional 13.2-kv. feeder for overhead area, conversion of 2.3- and 4.0-kv. distribution to 13.2 kv., rearrangements and improvements to underground conduit and cable systems, and the extension of the Lake Vista distribution system.

Additional boiler and generating capacity at the new Industrial Canal station will be completed for the summer peaks of 1947, Mr. McCoard said. He pointed out that at the Market Street station, boiler and generating capacity will be retired and replaced without major addition to the plant capability, and will be completed for summer peaks of 1948 to serve general system load.

•

Toledo Edison Co. Installs New Coal-Handling System

Toledo Edison Co. has started installation of machinery to be used in a $700,000 coal-handling system for its Acme power plant, H. H. Kerr, vice-president in charge of operation, has announced.

Included in the system will be a car dumper, a breaker building for coal-crusher operation, four silos with 500 tons storage capacity each and belt conveyors connecting the units.

The new system will replace a coal-handling arrangement designed when the Acme plant's capacity was only 50,000 kw. and which had been geared up to handle the 200,000-kw. war-time load of the plant, Mr. Kerr said. When the new project is in operation, probably by next fall, it will have a coal-handling capacity of 600 tons an hour, making possible processing and storage of a 24-hour coal supply during a normal day shift, he reported.

•

Sacramento District Must Pay Extra for Property

The Sacramento (Calif.) Municipal Utility District will be required to pay $1,482,000 to Pacific Gas & Electric Co., together with an additional sum for the current year, for improvements and betterments made during seven years in the district's electric distribution system that was acquired recently after a lengthy period of litigation from P. G. & E. (ELECTRICAL WORLD, April 20, Page 6) The valuation was determined by the California Railroad Commission.

Engineers for the district had set a $1,700,000 price on additional investments and depreciation from 1938—time that valuation of the properties had been fixed by the commission—and the date of transfer, while P. G. & E. engineers had specified $2,000,000. Although General Manager James E. McCaffrey of the district indicated that there was no way of estimating what the valuation of improvements would be for 1946, the 1945 estimate was for $125,000.

At any rate, the fact remained that a sum in excess of the $1,482,000 figure will be tacked to the original purchase price of $11,632,000, with Superior Judge Warren Steel recently approving extension for the time of payment to be made within a year of the final date of the condemnation judgment.

New policies currently being set forth by the district, which is scheduled to take over the system January 1, include creation of seven types of positions, with salaries ranging from that of chief electrical engineer, to pay $500 to $600 monthly, to personnel technician, $200 to $250.

•

Utilities Bill Tax Passed

Punta Gorda, Fla., has placed a 10 percent tax on all utilities bills, limiting the tax on each service to a maximum of $25. Beginning with September service bills, the tax will apply to electric, gas, water, telephone, and telegraph services.

•

$500,000 for Lines

Calgary Power Co. will spend approximately $500,000 on transmission line construction in northern Alberta.

Cambridge (Mass.) Electric Plans New Steam Station

Plans are developing for the construction of a second steam-electric generating station for the Cambridge (Mass.) Electric Light Co., to be located on First St. in the eastern section of the city and in the vicinity of the Broad Canal and Charles River Basin, the objectives being to supply additional energy to industrial plants and other consumers as well as steam for heating service. The initial installation is expected to include two 200,000-lb. per hr. boilers capable of burning either coal or oil, and a turbine-generator to operate at about 1,350 psi. Boiler pressure will be about 1,450 psi. and the steam temperature 900 deg. F.

The new plant will be interconnected with the existing Blackstone St. station approximately 1.5 miles up the Charles River from the lower Basin. Steam for industrial use will be extracted from the new turbine, which is to have a rating of about 18,000 kva. The company has important interconnections with the Boston Edison system, on the opposite side of the Charles, and supplies the town of Belmont with bulk electrical energy. Postwar growth of loads in Cambridge, which is an important industrial and mercantile city as well as a university and college center and residential municipality of over 110,000 population, is expected to require completed construction of the new plant within the next year or two. Engineering of the new station is being handled by the NEGEA Service Corp., Cambridge.

•

Apprentice Training Up

Apprentice training programs in the electrical industry jumped from 2,336 at V-J Day to 4,062 by the end of last April, William F. Patterson, director of the Labor Department's Apprentice-Training Service disclosed recently.

Patterson, speaking at graduation exercises for a class of New York City apprentices, praised the electrical contractors and labor groups which have cooperated to make the program a success. Their cooperation he declared, will be an asset to the Veterans Housing Program, which has been one of the few "must" programs of the Federal Government in recent months.

•

Standards Catalog Ready

A catalog listing the 845 standards approved by the American Standards Association can now be secured without charge from the association office, 70 East 45th St., New York 17, N. Y.

Krug Sees Interstate Transmission Grids as Part of Government Program

Secretary of Interior, in First Post-War Issue of Reclamation Bureau Magazine, Favors Public Power Where It Can Be Coordinated With Water Control—Believes Private Utilities Can Expand

THE POSSIBILITY that interstate transmission grids may form part of the federal government's power program at some future date was raised this week by Interior Secretary J. A. Krug.

Writing in the first post-war issue of the Reclamation Bureau's publication, *The Reclamation Era*, Krug indicated that such grids might play an integral part in the Interior Department's coordinated valley resource development program. In addition, he asserted that, under wise administration by both parties, no insoluble conflicts need develop between public power and private power.

"I can say," Krug wrote, "that I am in favor of the development of public power where it can be provided economically in coordination with the basic water-control functions of the Federal Government. Low-cost power means the stimulation of small business, an increase in domestic conveniences, and an increase in military strength.

Public—Private Relations Difficult

"The relationship of an expanded public power program to the private utility industry involves many difficult problems, which will not instantly be resolved. Public agencies can often develop the water power of an area to its maximum through multi-purpose projects which include irrigation, navigation, flood control, municipal water supply, and other purposes. The sale of power can be applied to help carry the cost of building irrigation and other water-control projects.

"The most economical development of water resources often involves operations which extend into several states, and only a government agency is in a position to resolve the conflicts which arise from enterprises of this scope. It is not impossible, moreover, that in the future it will be desirable for the government to construct great power grids which will distribute electrical energy over wide areas.

"However great the development of public power may be, it probably will not keep pace with the increasing use of electricity. Hence, the field for private utilities also is likely to expand. If expansion of both private and public power production is wisely administered, there need be no insoluble conflicts between them. Overreaching or too rapid expansion by either, or employment of unsound methods, would weaken the position of either.

"We are discovering that government must exercise leadership in many fields of economic activity, if the nation is to avoid excessive peaks of inflation and depression. Coordinated valley resource development, price control and maintenance of agricultural parity prices, construction of the vast industrial plant which produced munitions of war—all represent fields in which government has had to assist private industry in the interest of all of the people.

"The more you think about the matter, the more it becomes clear that the further development of our remaining natural resources of the United States, including the electrical energy which can be produced from its rivers, is one of the fields in which government enterprises has come to stay.

"In administering my responsibilities in this respect, I shall not overlook the private interests affected. I recognize that our system of capitalistic enterprise depends upon healthy private business, and I have no desire to replace private with government-owned enterprise.

"I intend to take up each problem separately as it arises, and in each instance to consider long-term consequences as well as the immediate results. But the final pattern of how the public domain is to be administered must rest with the people. I can only make recommendations to the Congress when a new pattern of administration is being evolved."

•

Gulf States Utilities Buys Lake Charles Power Plant

Gulf States Utilities Co. has purchased a 35,000-kva. generating plant erected by the Defense Plant Corporation early in the war to serve the Mathieson Alkali Works at Lake Charles, La.

With the purchase, for $2,408,126, comes the end of a tangled story of war power supply which, just a year ago, was a burning issue between the Interior Department and the Office of War Utilities.

The 35,000-kva. turbo-generator included in the transaction was built originally for the Lake Catherine, Ark., aluminum plant, but was diverted to Lake Charles in defense-program days. It was never used at Lake Charles, while the load it was meant to serve at Lake Catherine was carried by the Southwest Power Pool and the Ark-la Cooperative, which took its energy from Grand River Dam.

Late in the war, as power supply in the Southwest grew increasingly tight, Interior attempted to obtain transfer of the unit back to Lake Catherine where it was ultimately to be tied into Interior's Southwestern Power Administration system. After long study, OWU approved the transfer on the basis of necessity to

MORE POWER CAPACITY—Construction progresses on the addition to the Williamsport, Md., plant of Potomac Edison Co. which will house the new 30,000-kw. generating unit. Sanderson & Porter have the construction contract on the new unit which is to cost approximately $4,000,000 and will be completed in July, 1947

meet a war emergency. Negotiations undertaken between Interior and DPC, owner of the machine, dragged so long that the German war ended before the machine was ready for shipment. With the post-V-E Day slackening of war loads in the Southwest, OWU cancelled its war emergency certificate for transfer, a move which brought it as much criticism from Interior as its previous approval of the change had brought from private power companies affected.

The 35,000-kva. unit was installed in one of two power plants at Lake Charles, along with 420,000-lb. per hr. oil and gas-fired boiler. Installed in the other plant, as yet unsold, were eight 7,500-kw. full condensing steam turbines and one 15,000-kva. steam turbine, all served by common auxiliaries and eight 134,000-lb. per hr. oil and gas fired boilers. Two of the eight, 7,500-kw. machines have been moved out of the second Lake Charles plant, one to the Albuquerque Gas & Electric Co., and another to Pearl Harbor, whence it was shipped back to the United States some time ago. It is reported that the latter unit was ruined in shipment back to the mainland through improper protection against the elements to which it was exposed by being shipped on the deck of a cargo vessel.

•

Chinese to Install 50,000 Kw. in 10 Units and 7 Plants

Steam-electric power generating capacity totalling 50,000 kw. will be installed in seven plants in China. Gilbert Associates, Inc., has contracted with the Chinese Supply Commission to design, erect and operate initially such equipment.

Total cost, estimated at anywhere from $6,000,000 to $9,000,000, will be borne by the Chinese Government. Bids have been received from various U. S. manufacturers, but no awards have yet been made.

The capacity will be in standard 5,000-kw. units, three of which will be located in one plant, two in a second, and one each in five additional plants. No firm decisions have yet been made regarding the location of this capacity, but it is believed likely that one will be in Siam, several in or near Hankow, and at least one in Shanghai. Delivery of the first unit is hoped for in 12 to 14 months.

The generators will operate at 50 cycles, 69 kv., served by low-temperature, low-pressure coal-fired boilers. The equipment, which it is expected will be followed by more capacity as part of the present program, will be assembled at a West Coast port for shipment as soon as possible.

Withdraws Appeal

Attorney William Ritchie has asked for a dismissal of his appeal from a Federal Power Commission ruling affecting the Nebraska Power Co. He had filed an appeal in the Eighth Circuit Court of Appeals against an FPC ruling disclaiming jurisdiction over Nebraska Power's application for permission to borrow $7,000,000 to retire its preferred stock. Permission to proceed with the refinancing has been granted by the Nebraska Railway Commission.

Mr. Ritchie, who has two cases pending in Federal District Court against the utility, said he intends to proceed with them.

The litigation followed the sale of the utility to a non-profit organization.

MEETINGS

National Electronic Conference—Second annual conference, Edgewater Beach Hotel, Chicago, Ill., October 3-5. E. H. Schulz, secretary, Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, Ill.

National Electrical Contractors Association—Annual meeting, Ritz Carlton Hotel, Atlantic City, N. J., October 14-18. C. J. Harder, national secretary, 633 Investment Bldg., Washington 5, D. C.

Electrochemical Society—Fall meeting, Royal York Hotel, Toronto, Canada, October 16-19. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

American Welding Society—Annual meeting, New York, N. Y., October 24, and Atlantic City, N. J., November 17-22. M. M. Kelly, secretary, 33 W. 39th St., New York 18, N. Y.

National Electrical Manufacturers Association—Annual meeting, Marlborough-Blenheim and Claridge Hotels, Atlantic City, N. J., October 28-November 1. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Previously Listed

Rocky Mountain Electrical League—Annual convention, Stanley Hotel, Estes Park, Colo., September 5-7. R. B. Hubbard, manager, Gas & Electric Bldg., Denver 2, Colo.

Instrument Society of America — National Instrumentation Conference and Exhibit, Wm. Penn Hotel, Pittsburgh, Pa., September 16-20. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

Illuminating Engineering Society — National convention, Chateau Frontenac, Quebec, September 18-21. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

International Association of Electrical Inspectors—Northwestern Section, Boise Hotel, Boise, Idaho, September 23-25; W. L. Gaffney, secretary, 402 City Hall, Tacoma 2, Wash. Southwestern Section, Hotel Sacramento, Sacramento, Calif., September 30-October 2; H. L. Gerber, secretary, 205 City Hall, San Francisco, Calif. Southern Section, George Vanderbilt Hotel, Asheville, N. C., October 14-16; A. M. Miller, secretary, 910 W. 30th St., Richmond 24, Va. Western Section, Gibson Hotel, Cincinnati, Ohio, October 21-23; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis 9, Ind. Eastern Section, Mark Twain Hotel, Elmira, N. Y., October 28-30; F. N. M. Squires, secretary, 85 John St., New York 7, N. Y.

Municipal Electric Utilities Association of New York State—Annual conference, Mark Twain Hotel, Elmira, N. Y., September 25-27. T. J. McKee, secretary, 200-212 E. Third St., Jamestown, N. Y.

American Society of Mechanical Engineers — Fall meeting, Statler Hotel, Boston, Mass., September 30-October 2. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Texas Electric Service Co. Plans $8,000,000 Construction

Texas Electric Service Co., Fort Worth, Texas, has launched an $8,000,000 program of power plant and line construction to be completed within two years, J. B. Thomas, president has announced. The major project in the program will be the installation of a 40,000-kw. turbine-driven generator in the company's power plant at Handley, near Fort Worth. This unit, order for which was placed last year, will be one of the largest in use by any public utility in Texas, and is expected to be in operation by the middle of 1947.

Along with the expansion of the Handley plant will be the construction of 50 miles of 60-kv. power line which will complete the industrial power loop around Fort Worth and will greatly enlarge the area in which large industries may receive power direct from high voltage lines.

Extensions to the company's power transmission system will be made, Mr. Thomas said, to provide ample channels for marketing the incidental power output of governmentally financed flood control and reclamation dams, wherever suitable contractual arrangements can be made, and any savings therefrom will be passed on to the public by the company.

Important construction projects in the West Texas area served by the company include a 66-kv. line into the North Cowden and Fullerton oil fields in the Permian basin.

•

Los Angeles Electric Board Budget Totals $80,305,000

A preliminary budget for the fiscal year beginning July 1 that totals $80,305,000 for the electrical system of Los Angeles, Calif., was submitted recently to the Board of Water & Power Commissioners by General Manager Samuel B. Morris, who estimated that revenues from the sale of electrical energy would be $42,750,000 for the coming twelve months.

Estimated expenditures include $21,786,000 for operation and maintenance, $7,000,000 for bond interest and redemption, and $22,728,000 for capital expenditures.

•

Will Increase Capacity

Voters of Columbus, Ohio, have approved a $500,000 bond issue to be used in financing a $1,100,000 improvement program at the municipal power plant. Improvements will provide an additional 3,000 kw. of capacity to the present 13,500 kw.

I.E.S. Picks E.C. Crittenden to Receive Annual Award

Chief of Electrical Division, National Bureau of Standards, Will Get Medal at Convention

Eugene C. Crittenden, chief of the Electrical Division, National Bureau of Standards, Washington, has been awarded the Illuminating Engineering Society Medal, highest honor in the field of lighting.

The medal, presented annually "in recognition of meritorious achievement

which has conspicuously furthered the profession, art, or knowledge of illuminating engineering," will be presented at the annual convention of the society to be held September 18-20, at Quebec.

Probably the most outstanding of Mr. Crittenden's many notable achievements in illuminating engineering are his contributions to the development and establishment of acceptable standards and units for the measurement of light. He entered this endeavor about the time that the International Candle, founded on the performance of a group of carbon filament incandescent lamps, was adopted as a unit of light measurement by Great Britain, France, and the United States, on the initiative of this country.

Assuming a leading role in the efforts to overcome the shortcomings of that unit, he devoted many years to the development of the New Candle, based upon a reproducible primary standard, making suitable evaluations for variations in color of light, and adjusted to the needs of newer illuminants. He not only steered the progress of this work in this country but succeeded in securing the approval of the New Candle by the International Commission on Illumination and the International Committee on Weights and Measures which were established by treaty between the leading nations.

The unit was adopted by the International Committee in 1937 and by the I.C.I. in 1939, with plans for its universal adoption in 1940. Despite the interruption of the war, it is still the most promising proposal for world-wide agreement on a unit of light measurement, as soon as normalcy permits. This new unit will make possible the accurate interchange of data between nations.

For 20 years, Mr. Crittenden was chairman of the I.E.S. Committee on Nomenclature and Standards and was active on the Committees on Vocabulary and on Definitions and Symbols.

He was president of the I.E.S., 1924-25, and is a fellow of the society. For six consecutive years, he served as president of the U. S. National Committee of the I.C.I. At present he is chairman of the Standards Council and a director of the American Standards Association.

•

BPA Establishes Training Program for Service Vets

Bonneville Power Administration has established a region-wide apprenticeship training program to provide the best possible employment opportunities for returning war veterans. The program is the first federally sponsored apprenticeship training plan to be developed in cooperation with organized labor and the first to cover more than one state.

Bonneville employees in Oregon and Washington will be covered by the program which will be applicable to a number of crafts including electricians, linemen, carpenters, machinists, substation operators, painters, and automotive machinists.

•

Municipal Will Use Diesels

Tipton, Ind., will install two 2,400-hp. diesel engines in its new municipal light plant.

Output Statistics Delayed

The output graph and statistics of electrical energy distribution in the United States which regularly appear on this page are omitted in this issue because data were not available when this issue went to press. Regular publication will be resumed in the next issue.

Pacific Gas & Electric Co. to Abide by Labor Ruling

A. Emory Wishon, vice president and general manager of the Pacific Gas & Electric Co., has announced that the company will abide by the recent recommendations issued by a presidential fact-finding board in a wage dispute with the U.W.U.A., C.I.O. (ELECTRICAL WORLD, May 18, page 15).

After extensive hearings, the fact-finders recommended an 18½ percent increase for physical workers above V-J Day rates, a figure that had been previously offered by the company. For clerical workers an increase of about 21 percent was recommended, subject to variation due to certain adjustments for sex, location, classification, and other factors. This was 5 percent more than had been offered during negotiations.

The board also recommended increased retroactivity of as much as two months in some classifications.

Although A.F.L. and non-organized workers had accepted all company wage adjustments and only about 3,500 C.I.O. members were involved in the present dispute, Mr. Wishon said the increases would benefit all employees, numbering about 10,000. The fact-finding board's recommendation will result in retroactive payments of $238,000, and increase the general payroll by $576,000 annually.

Danger of a strike that threatened electrical service in San Francisco and adjacent areas had been averted earlier by the union's agreement to abide by recommendations of the fact-finding panel. Although the company did not agree to be bound by the panel's recommendations, it did accept them.

•

Valor Awards Revived

The Claude L. Matthews Valor Awards, suspended during the war, have been revived and will be awarded in 1947 for outstanding acts of courage and devotion to duty by employees of electric companies in 1946. All recommendations must be submitted to the secretary of Edison Electric Institute as soon as possible but in no case later than April 1, 1947. Employees of publicy owned utilities are also eligible.

•

Denied Bargaining Rights

The National Labor Relations Board has dismissed a petition by the International Brotherhood of Electrical Workers, A.F.L., for collective bargaining rights for certain employees of Dallas Power & Light Co. after an NLRB election which I.B.E.W. lost by a 95-81 vote.

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

GULF STATES UTILITIES Co.'s proposal to sell $27,000,000 of thirty-year first mortgage bonds, and the private sale of $2,000,000 of 1¾ percent serial notes, have been sanctioned. Proceeds, together with treasury cash, will be used to redeem the company's outstanding first mortgage and refunding bonds, 3½ percent Series D, due 1969. At the request of the company, the commission shortened the customary ten-day period for inviting bids to seven days. (Release No. 6700).

MINNESOTA POWER & LIGHT Co.'s proposal to call for redemption 24,040 shares of its 5 percent preferred stock at $104.50 a share, plus accrued dividends, has been approved. The stock to be redeemed will be selected by lot and will be canceled upon acquisition. The company has 149,040 shares of the preferred outstanding. (Release No. 6722).

MONONGAHELA POWER Co.'s request to purchase from its subsidiary, Marietta Electric Co., 3,750 additional common shares for $375,000 in cash has been approved. Monongahela at present owns all the 250,000 outstanding share of Marietta. Marietta will use the proceeds to pay its open account indebtedness of $85,000 to its parent, and to construct additions and improvements to its transmission and distribution system. Both companies are units in the American Water Works & Electric Co. system. (Release No. 6719).

WISCONSIN ELECTRIC POWER Co. has been authorized to sell competitively 260,000 new serial preferred shares, $100 par value, and $50,000,000 first mortgage bonds due 1976. The company also will sell to banks $5,000,000 serial notes, redeem for retirement all its outstanding 4¾ percent stock, and redeem outstanding 3½ percent first mortgage bonds due 1968. The company will offer holders of the preferred to be retired the right to exchange their stock for new serial preferred. The SEC shortened to six days the regular ten-day bidding period. (Release No. 6715).

IOWA PUBLIC SERVICE Co.'s proposed sale of $13,750,000 first mortgage bonds, due 1976, and 42,500 shares of $100 par value cumulative preferred stock at competitive bidding has been approved. The SEC shortened the regular bidding period to six days. Iowa Public Service also will issue to a bank eleven notes with an aggregate value of $1,750,000 and will issue 137,333 additional common shares, $15 par value, pursuant to a subscription offer to common holders, including Sioux City Gas & Electric Co. Proceeds will be used in part by Iowa to redeem outstanding first mortgage bonds, gold debentures and first and $7 second-preferred stocks. (Release No. 6716).

OHIO EDISON Co. has been given the green light on its proposal, over the protest of a group of common stockholders, to sell at competitive bidding 204,153 common shares, $8 par. Alfred J. Snyder, counsel for holders of about 1,000,000 common shares of Commonwealth & Southern Corp., parent company of Ohio Edison, urged the commission to defer action on the Ohio proposal until approval of a C. & S. recapitalization plan. (Release No. 6717).

ILLINOIS POWER Co.'s request that SEC extend time for filing briefs and reply briefs with respect to its claims against North American Light & Power Co. and North American Co. has been extended from June 24, 1946 to July 15, 1946 for the briefs and from July 9 to July 29 for reply briefs. (Release No. 6728).

•

California Pacific Utilities to Take Over Oregon Firm

J. A. Ward, president of California Pacific Utilities Co., has confirmed that his firm will take over the properties of Eastern Oregon Light & Power Co. on July 1. Financing will be handled by cash and through a six-month loan.

The San Francisco concern, which was temporarily halted in its Eastern Oregon take-over several months ago through the California Railroad Commission's ruling on competitive bidding, outlined its second plan for purchase as by means of sale of E.O.L. & P. properties to Union County People's Utility District for $1,256,732, and sale of a portion of a transmission line between Durkee and Baker, Ore., for $42,484 to Idaho Power Co., with both sums to be used to assume $1,800,000 of Eastern Oregon bonds. It was expected that the Oregon Public Utilities Commission would issue an order approving the transaction upon consummation of the deal.

Properties of Eastern Oregon comprise those in Grant, Baker and Union Counties, with the exception of a transmission line between LaGrande substation and Union-Baker county line, and two lateral lines in Union County.

•

Hydro License Granted

Wisconsin Public Service Corp. has been licensed until 1970 to operate and maintain a constructed project known as the Tomahawk hydro project, located on the Wisconsin River in Lincoln County, Wis., the Federal Power Commission has announced.

UTILITY REPORTS

	Net Income 1946	1945
*Alabama Power	$6,024,248	$6,947,340
*Connecticut Light & Power	4,617,184	4,089,783
*Consumers Power	9,839,168	7,071,392
*Georgia Power	6,493,309	4,841,989
*Iowa Public Service	871,410	652,062
*Iowa Southern Utilities	417,714	324,968
*New Orleans Public Service	2,436,644	1,984,848
*Ohio Edison	5,011,003	3,513,210
*Sioux City Gas & Electric	786,373	649,431

* Twelve months ended May 31.

Aldrich, Formerly of BPA, Heads Arizona Authority

Kenneth B. Aldrich, chief of the transmission development unit of Bonneville Power Administration, has been appointed director of the Arizona Power Authority by Governor Sidney T. Osborne. Willard Johnson of BPA's transmission development unit will also go to Arizona as chief of system development for the Authority.

Aldrich joined BPA in 1939 as electrical engineer for the system engineering staff. Later he transferred to the system planning and marketing division, and in 1941 he assumed the position from which he has just resigned.

Prior to joining BPA, he served six years as engineering investigator for the Public Works Administration, covering the eleven western states and Alaska. From 1928 to 1932, he was an electrical engineer for the Northwestern Electric Co., engaged in the design and construction of underground distribution facilities.

His engineering background also includes two years as consulting engineer for the Olympic Peninsula Light & Power Co., at Gig Harbor, Wash., and two years as instructor of engineering and higher mathematics at Oregon Institute of Technology. He also served as consulting engineer for the Oregon Hydroelectric Commission and as extension faculty member of the University of Oregon.

He received his education in civil and electrical engineering at the College of Puget Sound and the University of Washington.

Johnson, a graduate of Oregon State College, began his electrical engineering work with Pacific Coast power companies following the first World War. After private practice as a consulting engineer, he joined Bonneville in 1941.

•

Petitions May Lead to New Spokane Lighting Systems

Petitions to substitute new ten-year contracts between the City of Spokane and Washington Water Power Co. will shortly be circulated that will, if signed by a majority, permit modernization of the downtown ornamental lighting system. Now maintained by nine local improvement districts and the city through a power company contract, the system has been judged antiquated and could be replaced without additional cost to property-owners or the city if the present contracts are cancelled, according to Public Utilities Commissioner Willard Taft.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

"Tea Wagon" Facilitates Testing in Meter Lab

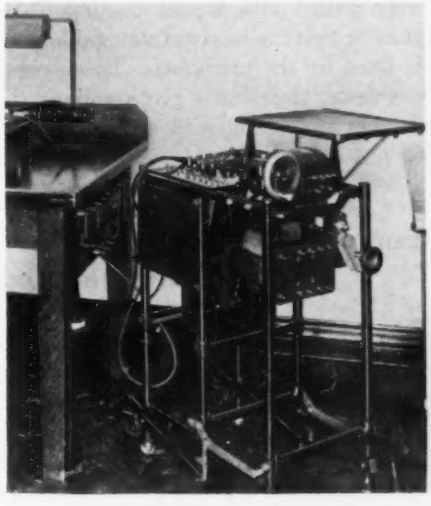
F. H. ROGERS,
Supt. Meter & Installation Department Consolidated Gas, Electric Light & Power Co. of Baltimore

SUPPLYING the proper voltage and current for testing electric meters, when and where needed, is the function of what has been called a "tea wagon" by those who use it. Mounted on an adding machine stand, it consists of transformers, resistors, and a regulator through the use of which any current from 0 to 160 amp., and any voltage from 0 to 600 volts, may be obtained.

The iron from an old distribution transformer supplied the core on which two 120-volt windings and two 6-volt windings were installed, the low-voltage windings having a current capacity of 80 amp. each. Both the primary and secondary of the transformers can be connected in parallel or series by the use of links mounted on the terminal board. Two banks of current-limiting resistors are connected to the links and are connected in parallel or series along with the secondary of the transformer. This arrangement assures against overloading of either the resistors or the transformer. Toggle switches, mounted on the connecting board, serve to vary the resistance of each bank. A carbon tube rheostat is also mounted on the stand and is used whenever closer adjustment than that provided by the fixed steps of the resistors is required.

A 100-watt, hand-operated induction regulator, 120-240 volt primary, 0-120 volt secondary, is mounted on the stand for varying the potential output. The output of the regulator can be fed into the potential transformer, constructed in our shop, consisting of five 120-volt windings, thus supplying any voltage from 0 to 600 volts. The "tea wagon" is plugged into a standard 120-volt receptacle.

There are ten meter test tables in the laboratory with which this portable outfit can be used. Its use has proven far more practical than if similar equipment were mounted stationary on any one test table, as its large, rubber-tired wheels permit it to be moved readily.



ADDING MACHINE STAND supports transformers, resistors, and a regulator which make up the "tea wagon" for meter testing

• • •

Liquid Cooling of Turbine Generators

CARL J. FECHHEIMER
Consulting Engineer,
Milwaukee, Wis.

AT A RECENT MEETING of the Edison Electric Institute committees in Chicago, the author told of the many gains that may be effected by liquid cooling, as compared to air or hydrogen, in turbine-generators. He showed a practical means for the liquid to enter, pass through, and be discharged from, a turbine-generator rotor, without giving trouble. During its passage through the rotor ducts the heat generated in the rotor windings is transferred to the liquid. He also indicated practical means for cooling the stators with transformer oil or "pyranol," and the advantages to be gained thereby.

It is recognized that, aside from magnetic saturation and mechanical stresses, it is the temperature rise of the rotor winding that imposes the limitation as to over-all dimensions, when the load current lags behind the voltage. Consequently, if the liquid coolant affords much better heat transfer and heat absorption than does the gas, a machine of smaller dimensions, weight and cost for a given rating is made possible.

Heat transfer and heat absorption rates of the coolant are dependent upon four physical properties: heat conductivity, specific heat, specific gravity, and viscosity; the liquid selected should have suitable values of these. There are several liquids which would be suitable as coolants for the rotor.

Differential temperature, longitudinally and radially, of the embedded copper in the rotor slots has given rise to unequal expansion (and contraction) forces, and has caused considerable trouble.* In very long rotors with deep slots, cooled with either hydrogen or air, it is impossible to secure even an approximate equalization of rotor copper temperature. On the other hand, with a suitable liquid coolant, the steel in the rotor teeth is nearly uniform in temperature, and therefore the embedded copper temperature is also nearly uniform.

A minor advantage with liquid cool-

* See paper by J. G. Noest: "Prevention of Rotor Winding Deformation on Turbo-Generators," "Electrical Engineering," July, 1944, pages 514-519. Also, paper by G. A. Juhlin, "Journal of the Institution of Electrical Engineers," (British), 1939, pages 544-552.

ing of the rotors is that the temperature rises of the copper and steel above the entering liquid temperature can be predicted with only a small percentage of error. With gas cooling, the rather uncertain gas paths and heat transfer rates, and the complex heat flow, defy calculation.

In the stator there are also considerable gains with liquid cooling. Assuming that the internal stator diameter is fixed by the previously chosen rotor diameter, then for a given voltage the thinner insulating wall and very small space occupied by the cooling ducts make for a smaller external diameter than would be possible with gas cooling. Also, if desired, the stator can be wound for considerably higher voltage than is practical with gas cooling, and corona is entirely absent.

The mechanical construction is covered for the most part by U. S. patents 2,285,960 and 2,381,122, although there have been a few improvements since the patent applications were filed. Since it is well-nigh impossible to drill holes of great length of suitable diameter longitudinally in solid rotors, rectangular or trapezoidal slots can be machined in, and adjacent to, the rotor teeth and below the main slots; the outer parts of the duct-slots that are not needed for the cooling ducts are subsequently filled with steel pieces and welded in position.

A more complete paper is in preparation, to appear in the near future.

It is believed to be as large a step from hydrogen cooling to liquid cooling as it was from air to hydrogen cooling.

• • •

Completed Costs of Two Rural Extensions

FROM the field sheets of an eastern power company are taken the following completed costs of two rural line extensions built in late 1944, one being 5,222 circuit-ft. and the other 1,830 circuit-ft. long. The latter line had only one size of poles.

The shorter line operates at 4,600 volts, single-phase and the longer at 2,300 volts, single-phase, both for 60 cycles.

In the reports labor costs are merged with the other itemized costs listed and are not separately available in the accessible data; but the field sheets give the total expense of construction and are thus available for comparative estimating purposes.

Itemized Over-all Cost of Rural Extension 2,300-Volt, Single-Phase, 5,222 Circuit-Ft.

Items	No.	Unit Cost	Total Cost
25-ft. Poles	1	$35.03	$35.03
30-ft. Poles	2	41.11	82.21
35-ft. Poles	19	48.60	923.42
40-ft. Poles	2	56.79	113.57
Guys	6	9.15	54.88
6-Pin Crossarms	28	3.60	100.91
Plank Anchors	3	11.66	34.97
No. 6, 3-Strand Rural Wire, 10,444 ft	.....	0.041	423.87
Lightning Arresters	2	7.85	15.70
Cutouts, 60-amp.	2	7.44	14.88
Services Run	.....	.....	26.40
Secondary Ground	1	10.23	10.23
Lightning Arrester Ground	1	10.59	10.59
	TOTAL		$1,846.66

Itemized Over-all Cost of Rural Extension 4,600-Volt, Single-Phase, 1,830 Circuit-Ft.

Items	No.	Unit Cost	Total Cost
35-ft. Poles	9	$39.89	$359.04
Guys	5	10.24	51.20
Plank Anchors	3	6.65	19.94
6-Pin Crossarms	12	3.30	39.55
7-ft. Alley Braces	2	3.36	6.72
No. 6 Rural Wire, 3,660 ft	.....	0.043	156.48
Lightning Arresters	2	12.60	25.21
Cutouts, 60-amp	2	6.94	13.87
Secondary Grounds	1	8.62	8.62
Lightning Arrester Grounds	1	8.71	8.71
Services Run	.....	.....	13.08
	TOTAL		$702.42

• • •

How to Joint an Aerial Cable

STANDARD PRACTICE of the United Illuminating Co., New Haven and Bridgeport, Conn., in making straight joints on single-conductor, rubber-insulated, shielded type aerial cables has been simplified into seven steps as follows:

(1) Training cable in place so that ends butt.

(2) Preparation:

Remove weatherproof finish for distance shown in diagrams for either 2.4 or 6.9 kv. Remove shielding tape to within 1 in. of this point. Remove cable tapes to within $\frac{3}{4}$ in. of shielding tape. Remove insulation from each conductor for a distance of one-half the length of the connector plus $\frac{1}{4}$ in.

(3) Applying connector:

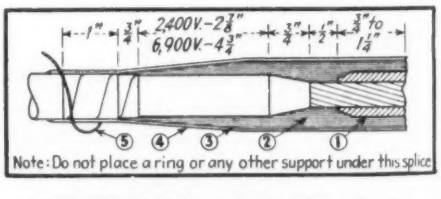
Protect insulation with asbestos roving. Tin and sweat on the connector. Wipe smooth before solder cools, removing all sharp points.

(4) Penciling insulation:

Pencil insulation for distance of $\frac{3}{4}$ in. starting $\frac{1}{2}$ in. from connector. Smooth with abrasive cloth.

(5) Applying insulation:

Coat entire insulation including pencilled portion and connector with rubber cement. Allow to set. Build up insulation using rubber splicing compound recommended by manufacturer to a thickness of $1\frac{1}{2}$



LONGITUDINAL SECTION of single-conductor, rubber-covered shielded type 2.4- and 6.9-kv. aerial cable straight joint. Circled numbers refer to items in material list table

List of Material

ITEM	QUAN.	DESCRIPTION
1	1	Connector *
2	†	Rubber Compound
3	15 ft.	Copper Mesh Braid
4	†	Friction Tape
5	†	No. 8 Stranded Wire
6	¼ lb.	Stick Solder; 50% Tin, 50% Lead
7	1	Pigtail Connector *
8	†	Insulating Paint

* Size as required † Quantity as required

times the cable insulation thickness over the connector. Taper the insulation both ways back to the edge of the shielding tape. In applying the rubber splicing compound be sure to apply smoothly, half lapped, stretching down to no less than three-fourths the original width in wrapping. Then roll down smooth using knife or roller. Apply one layer of half-lapped friction tape over rubber tape.

(6) Shielding tape and ground pigtail:

Apply copper mesh tape half-lapped over the entire insulation and extending ½ in. over factory shielding tape. Solder copper mesh tape to factory shielding tape at both ends and tack at intervals over entire length. At same time solder a No. 8 stranded ground pigtail to the shielding tape on each end on the under side. Connect these ground pigtails to the messenger, using a split bolt connector for the purpose.

(7) Finish:

Apply two layers of half-lapped friction tape over shielding tape and extending back over original weatherproofing. Apply two coats insulating paint.

• • •

Consider Utilities' Needs in Planning Subdivisions

NOTORIOUS among utility engineers are the difficulties encountered in building and operating electric and telephone lines in reserved strips, easements, alleys and streets where no advance provisions were made for such lines in making the original platting for residential subdivisions.

In Wichita, Kan., engineers of Kansas Gas & Electric Co. and the Southwestern Bell Telephone Co., acting jointly, have submitted to the Wichita Planning Commission a series of recommendations and suggestions to be followed in laying out new or revised areas, particularly where there are to be no open alley ways.

Recommendations of the two utilities were substantially as follows:

1. A permanent subcommittee should be established consisting of an engineering representative from each of the utilities serving the city; electricity, gas, telephone and water. Engineering department of the City of Wichita should be represented, particularly because sewer construction is involved. This subcommittee would function in an advisory capacity with the Planning Commission. Before a platting or replatting would be approved by the Commission, the proposed layout would be referred to the subcommittee to check the proposed plan for adequacy of easements and strips reserved for use of utilities. At this time, the committee would designate the most practical arrangement of the plants of the various utilities involved.

2. The following principles were suggested for governing procedure in laying out new or revised areas:

a. Make lot lines or property divisions meet at the same point at the rear line of lots or in the strip reserved for the use of utilities.

b. Make the property division line or reserved strip a straight line in each block insofar as possible, regardless of the curves in the street in front of the lots.

c. Lay out blocks so that overhead utilities can run in uniform or straight lines. This can be accomplished by eliminating offset easement in adjoining blocks.

d. Provide a statement on each plat to the effect that planting of trees or bushes or the building of structures be avoided in the strip reserved for the utilities' use.

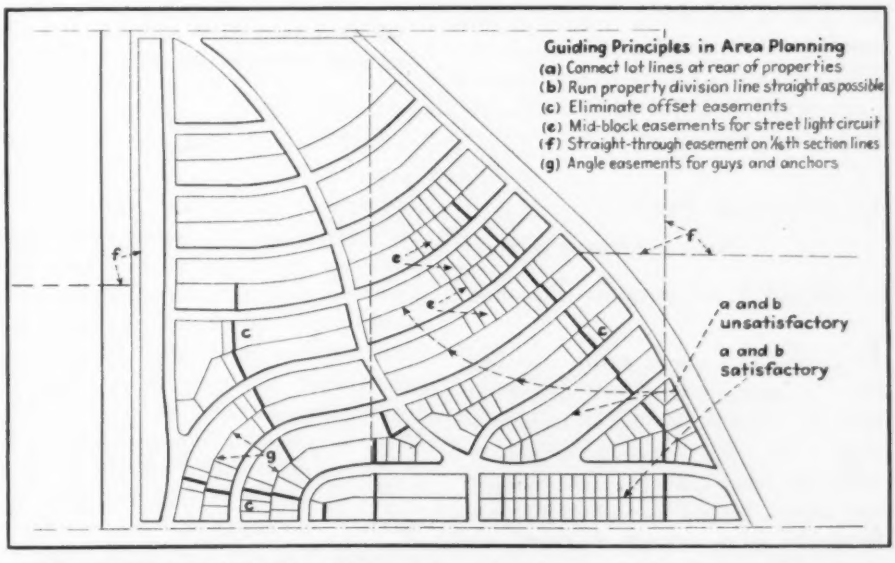
e. Make a mid-block easement leading from the reserved strip to the street, for the construction and operation of a street light circuit where blocks are over 750 ft. long. This same provision should be made for street light circuits which may be required in the future where no easement would otherwise be provided.

f. Make a straight-through easement on 1/16th section lines, if possible. This should be of a width adequate for the utilities' requirements.

g. Where angles are made in rear property lines, adequate angle easements should be provided for guys and anchors.

h. It is desirable to develop some systematic plan for keeping the property owner informed as to his limitations and responsibilities with reference to the reserved strips.

Lettered notations on the accompanying subdivision layout map illustrate the provisions recommended in the similarly marked paragraphs above.


Guiding Principles in Area Planning
(a) Connect lot lines at rear of properties
(b) Run property division line straight as possible
(c) Eliminate offset easements
(e) Mid-block easements for street light circuit
(f) Straight-through easement on 1/16th section lines
(g) Angle easements for guys and anchors
a and b unsatisfactory
a and b satisfactory

FOR BETTER PLATTING—Illustrated on the above sample map are suggested principles for use in laying out new residential developments, so that electric and telephone service lines can be built and operated effectively

Alter Rod Driver to Prevent Accidents

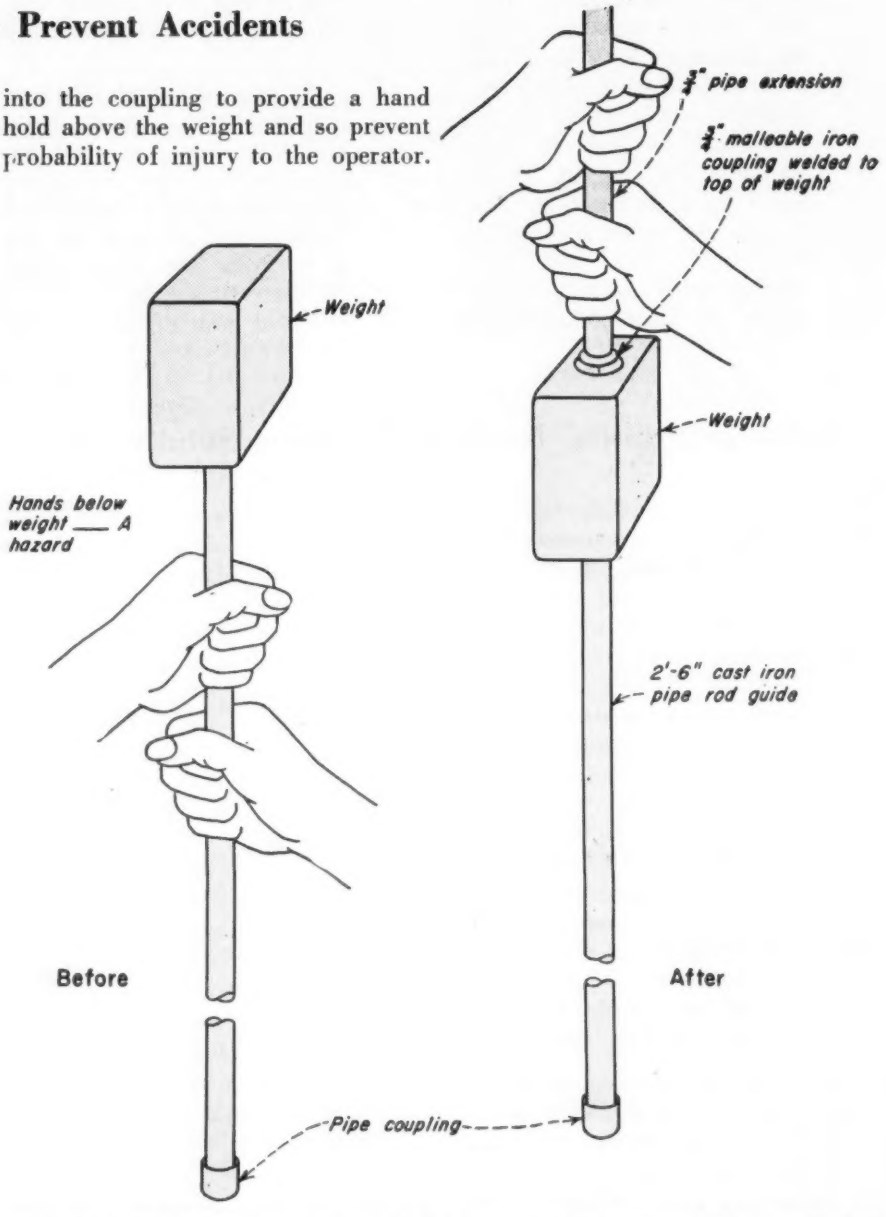
SEVERAL ACCIDENTS involving a round rod driver, in which men have had hands crushed or punctured, has led the accident investigating committee of Public Service Co. of Indiana, Inc., Indianapolis, to recommend alteration of commercial ground rod drivers used on the system.

The driver involved in past accidents has a rectangular iron weight (about 10 lb.) mounted on the top of a ¾-in. iron guide pipe 2 ft. 6 in. long that fits over the ground rod. A coupling and a 2 ft. 6 in. extension can make this rod guide 5 ft. long. The driver is designed so that the operator must hold the guide below the weight in order to use it.

Ordinarily, the entire 5-ft. guide is used. However, as the top of the ground rod gets within 5-ft. of the ground level, this extension is removed and the driver used with only the 2 ft. 6 in. section.

Accidents have happened when driving was almost finished and the rod guide extension consequently removed. The workman has raised the driver too high, allowing it to come off the end of the rod. On the next down stroke the operator's hand is caught between the end of the rod and the weighted head of the driver, tearing the flesh badly or running the ground through the operators hand.

To avert such accidents hereafter, Public Service Co. of Indiana, Inc., has simply welded a pipe coupling to the top side of the driver weight so that the bottom 2 ft. 6 in. section of the pipe guide can be removed and screwed into the coupling to provide a hand hold above the weight and so prevent probability of injury to the operator.



DESIGN CHANGES in ground rod driver keep hands from being crushed if ground rod slips out of its guide pipe

• • •

Distribution Staff Duties Summarized*

Electrical Construction Foreman

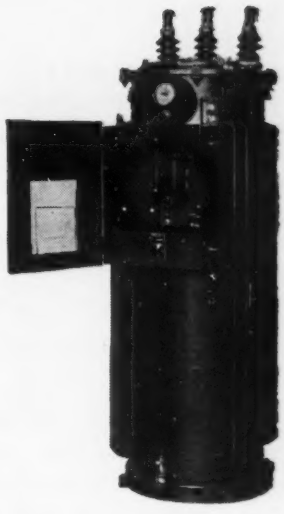
IN A typical Eastern utility the electrical construction foreman is responsible in the distribution department for the proper execution of electrical construction, maintenance and repair work, according to plans furnished him, except overhead and underground line work, and also for the detailed layout of such work when plans are not furnished in detail. His supervision also includes, under such conditions, the proper execution of mechanical work assigned him. When called upon to do so, he is expected to furnish assistance to other departments on construction, maintenance or repair work as called upon.

He sees to it that a periodical inspection is made of the electrical equipment at the company's main office building, including keeping it in proper order. He had direct charge of guards at the principal urban substation during the war and of any others assigned to guard duty. It was his task personally to instruct guards in their duties and he was at all times responsible for their conduct. Another task is cooperation with the maintenance supervisor and the preparation of a monthly schedule of oil circuit breaker inspections, their carrying out and completion on time. He reports upon unusual troubles in the departmental book of that title. In the absence of the maintenance supervisor, he attends to necessary duties allied with the supervisor's work. He is responsible for the test room (at the

* One of a series of presentations covering the essential duties of the officials of a public utility distribution department serving between 50,000 and 75,000 meters. First installment in ELECTRICAL WORLD, October 13, 1945, page 106.

INDUCTION REGULATORS

require practically no maintenance



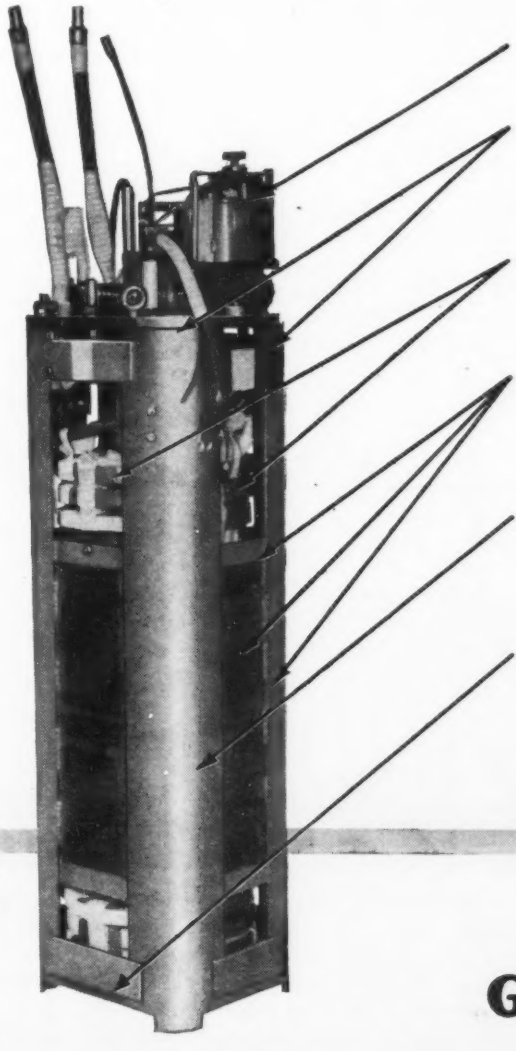
Long-life features of these G-E regulators combine to give you highest return from line voltage stabilization with practically no maintenance cost.

MAINTENANCE of a G-E Type IRS induction voltage regulator is very low. Long-term utility records show that it is almost non-existent. This is the type of regulator you can install and forget about except for routine inspections.†

Add these maintenance savings to those that result from a G-E induction regulator's prompt response to voltage changes, and you have a regulator that *produces a high return* on the investment.

Other benefits are: higher-quality service to customers, prevention of loss of revenue from low voltage, savings from reduced necessity for adding new feeder capacity. They all add up as dollars and cents earnings when G-E induction regulators are used!

Send for Bulletin GEA-2985, *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Capacitor Type Motor is easily accessible.

Accurately Machined rabbet joint of top stator plate assures permanent concentric alignment of the rotor and stator cores.

***Herkolite** reinforcing rings prevent distortion of the coils from over-current stresses.

Laminations of the Stator Core are compressed and welded to an all steel frame contributing to continued quiet operation.

Stator Frame, thoroughly braced at top and bottom, is welded into a single unit providing strength and rigidity to whole assembly.

Stator Bottom Plate is machined with a rabbet fit to assure correct centering of bearing cup for the rotor.

†We have recently been asked to rebuild one of our induction regulators which has been in continual operation for more than 40 years!

*Trade-mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC

404-39-5429

principal substation) containing fault location equipment and all apparatus contained in it. A regular duty is to see to it that repairs and replacements are made on this apparatus and that the room is kept clean at all times. He is also required to be available for handling unusual trouble and for circuit testing.

• • •

Effect of Temperature on Battery Charging

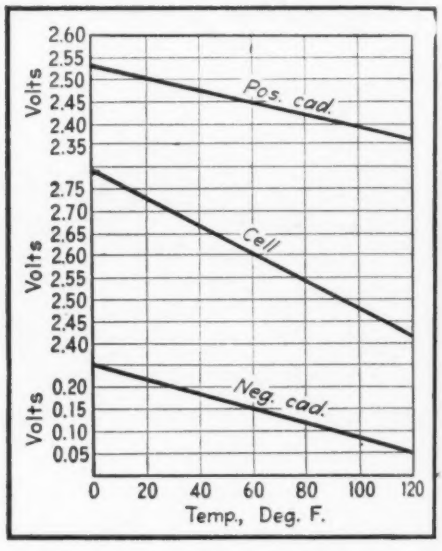
O. H. BAUER, Engineer, Philco Corp., Trenton, N. J.

EFFECT of cell temperature on end-of-charge voltage is very important especially in its relation to voltage relay control in terminating the charge of the battery. The accompanying curves show that the cell voltage and positive and negative plate potentials in reference to cadmium are linear functions of temperature. The lines are based on readings obtained at the normal finishing rate.

The cell voltage differential between 20 deg. F. and 120 deg. F.—which temperatures may be considered the extremes of operating conditions—is 0.32 volts. Both positive and negative plates share equally in this differential of voltage.

If a voltage relay control is set for 2.54 volts at a normal temperature of 77 deg. F., and if then the cell temperature should recede to 20 deg. F., this specific voltage will be reached much sooner, in which case the cell will be undercharged. On the other hand, with a temperature of 120 deg., this nominal voltage of 2.54 will never be reached, thereby resulting in severe overcharging unless the circuit is opened manually at the proper time.

An additional complication is introduced as the cell becomes old. Whereas a new cell at normal temperature will show 2.54 volts with a normal finishing rate, this voltage will drop to 2.40 with an aged cell. This represents a further differential of 0.14 volts and, when added to 0.32 volts for temperature differential, it makes a total of 0.47 volts. In other words the end-of-charge voltages of a new cell at 20 deg. temperature would be 2.73 as compared to 2.26 volts for an aged cell at 120 deg. The importance of temperature compensation is therefore quite evident.



EFFECT OF TEMPERATURE on end-of-charge cell voltage and positive and negative plate potentials

• • • •

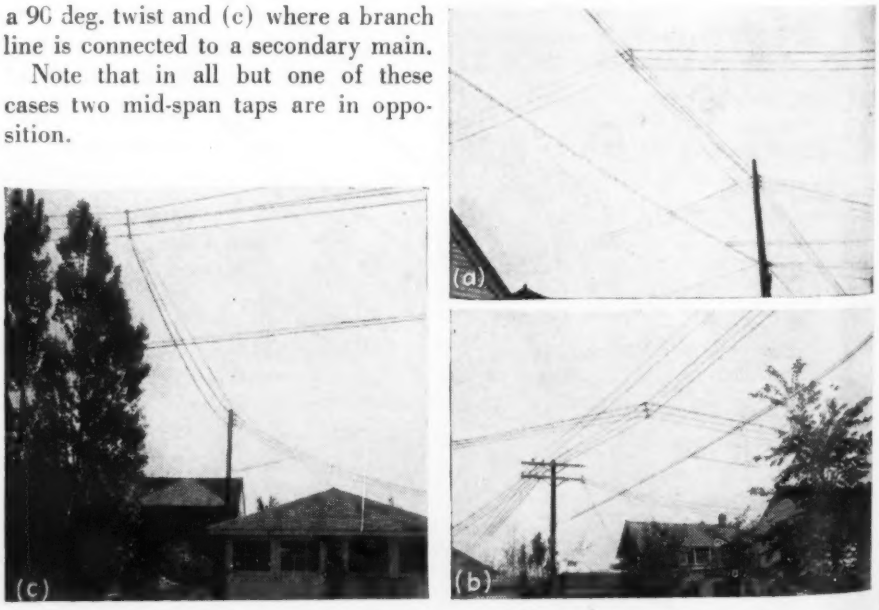
Use Mid-Span Taps To Clear Lot Corners

IN MILWAUKEE when stringing of secondary service drops to individual residences from secondary mains along rear lot lines (or elsewhere) is hampered by offset lot lines, the necessity of crossing the corners of lots is avoided by making "flying" mid-span secondary taps as shown.

Steel spreaders, equipped with porcelain spool insulators, are used for the purpose. During one period, however, creosoted wood spacers 19 in. long with notches on 8-in. spacing were used as a substitute on the Wisconsin Electric Power Co. system.

Accompanying photographs illustrate three common instances in which mid-span taps have been used: (a) Where secondaries are carried on racks in the vertical plane; (b) where secondaries are on crossarms and require a 90 deg. twist and (c) where a branch line is connected to a secondary main.

Note that in all but one of these cases two mid-span taps are in opposition.



TYPES OF MID-SPAN TAPS—Used to avoid crossing foreign lot corners, "flying" mid-span secondary taps fall into three common groups: (a) Those where secondaries are in vertical plane; (b) where secondaries are carried on crossarm and require 90 deg. twist and (c) where a branch secondary is connected to a secondary main serving a residential area

Based on the *DIRECT-HEAT* Principle

You get three new features of operation with the radically different and unique G-E thermal watt-demand meter because it is built upon the "direct-heat" principle. Unlike meters of conventional design, in the new G-E meter the current passes *directly* through the bi-metallic spirals of the temperature-sensitive unit. Each spiral serves not only as a temperature-sensitive element, but also as its own electrical-resistance heater. There is no separate heating element. This means for you:

● **High operating torque (2660 gram millimeters)—Because the heat is generated *directly* within the temperature-sensitive bi-metallic spirals, operating torque for the same watt loss is much higher than that obtained in meters of conventional design. This makes possible the use of sturdy parts in the driving mechanism, which in turn assures long-life accuracy, indicating-pointer stability, and low maintenance costs.**

● **Ideal response-time characteristics—The new G-E thermal watt-demand meter, unlike those built with separate resistance elements, follows in operation the ideal exponential curve, which admits of simple definition and easy mathematical analysis.**

● **Accuracy of indication—Pointer overshoot caused by continued transfer of heat from a separate resistance element after the load has been removed is eliminated.**

For complete information on this new development in the art of meter design, write today for "Thermal Watt-demand Meter GEA-4541," Apparatus Department, Schenectady, New York.

● **HIGH OPERATING TORQUE FOR:**

Sturdy parts

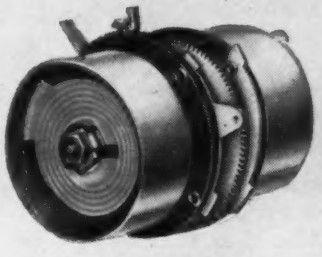
Long-life accuracy

Indicating-pointer stability

Low maintenance costs

● **IDEAL RESPONSE TIME CHARACTERISTICS**

● **ACCURATE INDICATION**



Direct-heat thermal element

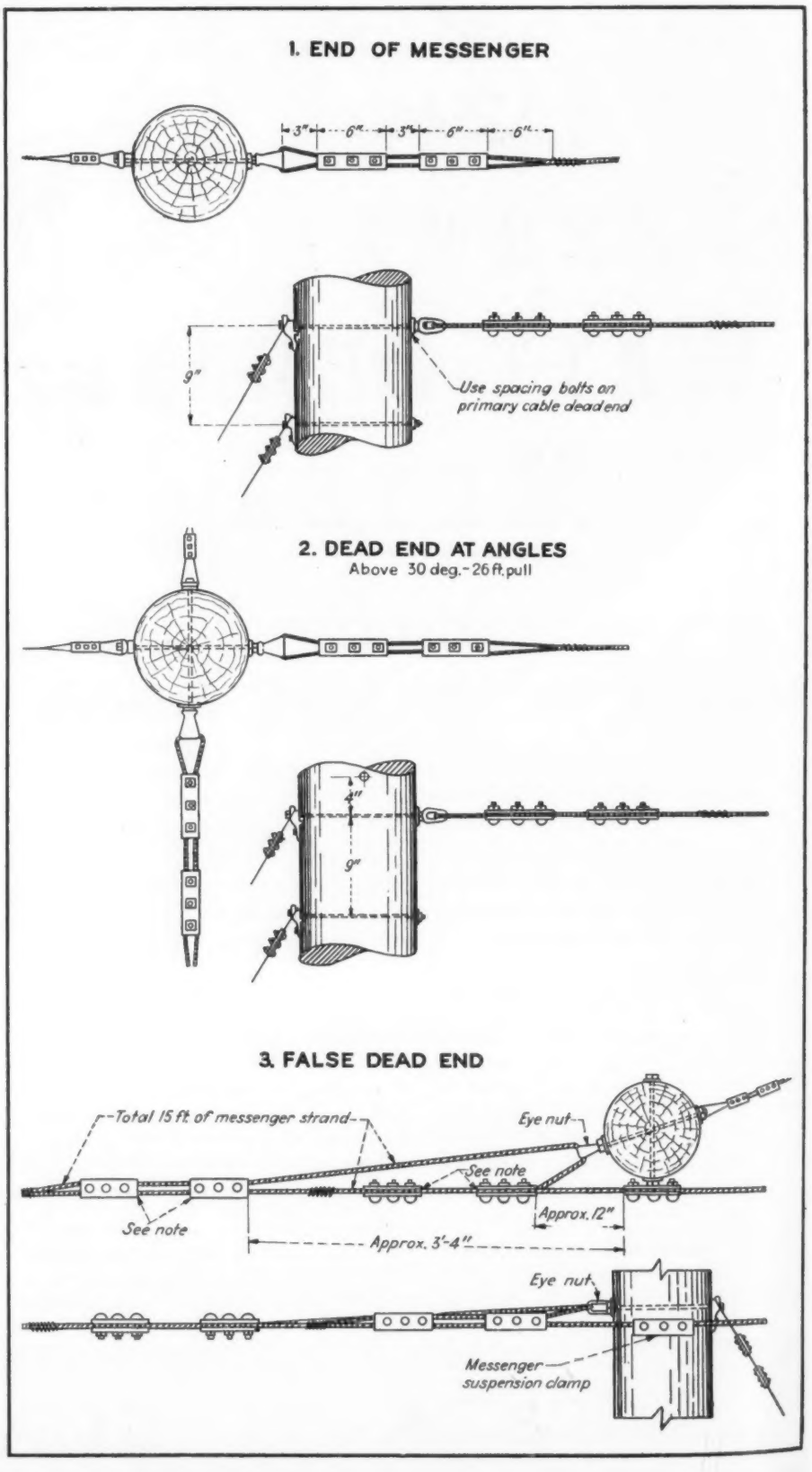
THE FIRST IN A FAMILY OF G-E THERMAL DEMAND METERS

HEADQUARTERS FOR MEASUREMENTS

GENERAL ELECTRIC

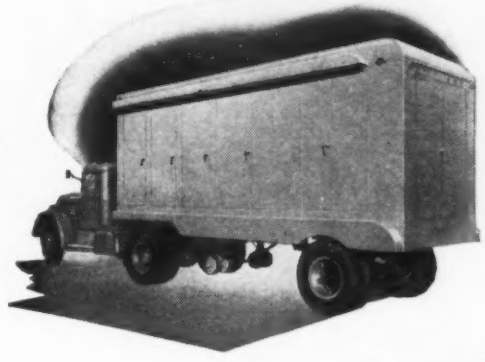
Dead Ending of Messenger Strands

Outline of construction for end of messenger, dead ends at corners or angles and false dead end; these are adaptations from standardized practices on overhead construction by Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y.



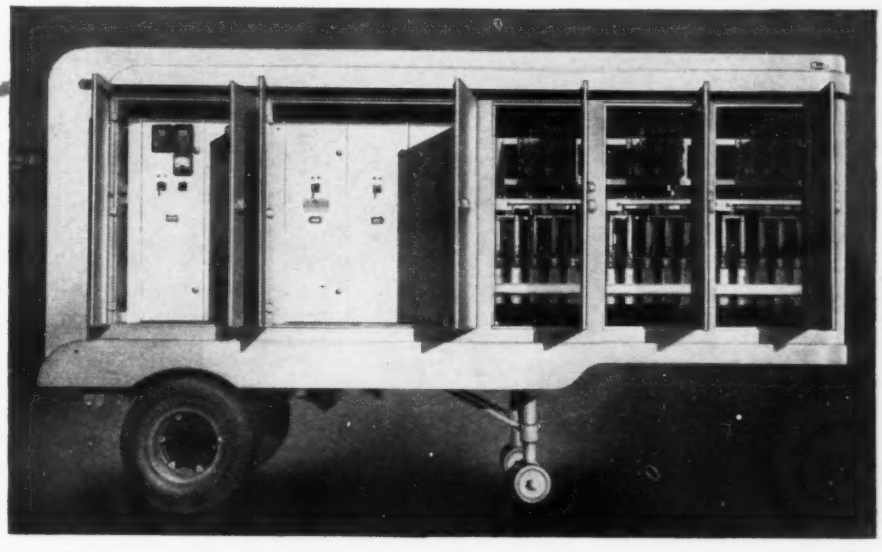
NOTE

Use one 3-bolt guy clamp with —
8,000-lb., $\frac{5}{16}$-in. H.S. steel strand
11,340-lb., $\frac{3}{8}$-in. H.S. Copperweld
Use two 3-bolt guy clamps with —
13,860-lb., $\frac{7}{16}$-in. H.S. Copperweld
14,500-lb., $\frac{7}{16}$-in. H.S. steel strand
Use $\frac{3}{4}$-in. bolt and $\frac{3}{4}$-in. eye nuts on —
All dead ends and false dead ends.



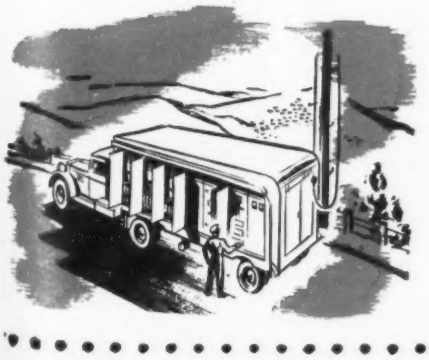
KILOVAR Canteen

New G-E Capacitor Trailer brings Kilovars Close to the Load!



With this capacitor-trailer, it is possible to pull up alongside the load and, with live-line clamps, connect in capacitors in sections of 180 kvar each to a total of 1080 kvar. The trailer is completely "self-contained" and includes one hand-operated magne-blast main breaker, and three magne-blast breakers which accomplish manual and automatic switching under load. Panel-mounted voltage and current meters are included for checking of capacitor results.

The equipment is rated 4160 volts, 3-phase wye, 60 cycles, 2400 volts delta. 72 individual capacitor units rated 15 kva, 2400 volts are arranged in racks. The use of highly stable, non-inflammable Pyranol capacitors together with magne-blast breakers eliminates the fire hazard. Built-in jacks enable quick leveling of the unit, and permit taking weight off tires if the unit is to stand for some time.



THIS new, complete, mobile capacitor equipment has recently been supplied by General Electric to the Consolidated Gas, Electric Light and Power Company of Baltimore.

The complete flexibility this unit affords will enable it to supply kilovars for emergency needs as well as to provide immediate voltage correction and power-factor improvement close to seasonal loads. In addition, its mobility permits it to be used as a capacitor laboratory on wheels for making full-scale tests on feeders to determine the needs for permanent capacitor installations.

So adaptable are capacitors in helping improve system load conditions that it is a logical step ahead for power companies to purchase equipments that can be moved from place to place. General Electric engineers will be glad to discuss with you the possible use of such equipment in your system. Write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

407-106-5700

Accuracy of Indicating Instruments And Some Influencing Factor Limits*

(Based on ASA-C39.1)

J. S. WANTLAND, Assistant Meter Supervisor, Oklahoma Gas & Electric Co., Oklahoma City

ACCURACY OF AN INSTRUMENT, as specified by the manufacturer, will be met only under certain conditions. Several important factors that affect instrument accuracy are:

1. Readability
2. Position error
3. Changes in ambient temperature
4. Electromagnetic fields
5. Electrostatic effects
6. Self heat
7. Changes in voltage (wattmeters, frequency meters and power factor indicators)
8. Changes in frequency (a.c. instruments)
9. Wave form (a.c. instruments)

The American Standard for Electrical Indicating Instruments (C39.1) covers certain kinds of electrical indicating instruments, giving definitions, classifications, characteristics, initial accuracies and influencing factor limits. In the accompanying tabulation an effort has been made to compile some of these specifications in order to emphasize to the user the importance of recognizing these factors that influence instrument accuracies.

Electrical Indicating Instruments, Initial Accuracy and Some Influencing Factor Limits (ASA C39.1)

TYPES OF INDICATING INSTRUMENTS	At 25 deg. C. and in Normal Operating Position	Max. Pointer Displacement at 30 deg. Inclination From Normal Operating Position	% of Full Scale With Temp. Change of ± 10 deg. C. from 25 deg. C.	% Change of Indication Due to Temp. Change Caused by Instrument Losses. Amb. Temp. 25 deg. C.	Max. Error Due to External Field of 5 Oersteds	Max. Error Due to ± 10% Change in Rated Frequency	Max. Error Due to ± 10% Change in Rated Voltage
	INITIAL ACCURACY %	POSITION INFLUENCE %	AMB. TEMP. INFLUENCE %	INT. TEMP. INFLUENCE %	EXT. FIELD INFLUENCE %	FREQUENCY INFLUENCE %	VOLTAGE INFLUENCE %
PORTABLE INSTRUMENTS—A.C. AND D.C.							
D.C. Grade A* (Best Available)	0.35	1.0	Note 1	Note 4	0.75	....	0.25
D.C. Grade B** (Moderate Accuracy)	0.50	1.0	Note 2	Note 5	5.0	....	0.25
A.C. Grade A (Best Available)							
Voltmeters	0.3	1.0	0.25	0.2	0.75	0.5	....
Ammeters and Milliammeters	0.5	1.0	0.25	0.2	0.75	0.5	....
Wattmeters (S.P.)	0.3	1.0	0.25	0.15	0.75	0.5	0.25
Wattmeters (P.P.)	0.5	1.0	0.25	....	....	0.5	0.25
A.C. Grade B (Moderate Accuracy)							
Voltmeters	0.8	1.0	0.5	0.5	5.0	0.5	....
Ammeters and Milliammeters	0.8	1.0	0.5	0.5	5.0	0.5	....
Wattmeters (S.P.)	0.8	1.0	0.5	0.5	5.0	0.5	0.25
SWITCHBOARD INSTRUMENTS—A.C. AND D.C.							
Scale Length 4½ in. and Greater	....	....	d.c. Note 3 a.c. 0.25	....	d.c. Note 6 a.c. 4.0	....	....
Ammeters, Voltmeters and Wattmeters	1.0	2.0		....		0.5	0.5
Power Factor Meters, 1/5 Rated Current and Above	0.01†	2.0	0.005†	....	0.03†	.....	0.005†
Frequency Meters—60 Cycles	0.5	2.0	0.35	....	2.5	....	0.25
Frequency Meters—25 Cycles	1.0	2.0	0.35	....	2.5	....	0.25
Scale Length Less Than 4½ in.	2.0	2.0	0.25	....	5.0	0.5	....

Note 1. 0.2% for voltage circuits. 0.3% for current circuits operating from 100-mv. or 200-mv. shunts. 1.0% for current circuits operating from 50-mv. shunts.

Note 2. 0.4% for voltage circuits. 0.5% for current circuits operating from 100-mv. or 200-mv. shunts. 1.5% for current circuits operating from 50-mv. shunts.

Note 3. 0.35% for instruments having one or more voltage circuits. 1.0% for instruments having one or more current circuits.

Note 4. 0.1% for voltmeters and ammeters.

Note 5. 0.2% for voltmeters and ammeters.

Note 6. Both a.c. and d.c. instruments with metal cases and scale length of 2½ in. or larger shall be shielded, but shielding not required for instruments with insulating cases. Influence on d.c. instruments shall not exceed 1%.

* Grade A portable instrument is defined in general as a portable instrument intended for uses which warrant the best available commercial instrument as to accuracy under normal conditions and as to low values of the various applicable influences.

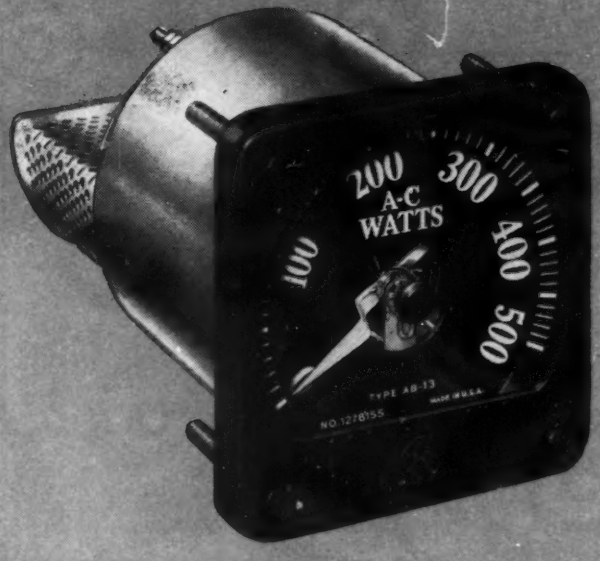
** Grade B portable instrument is defined in general as a portable instrument intended for uses for which moderate accuracy and moderate values of the various applicable influences are sufficient.

† Value is for power factor and not percent.

* *From a paper, "Accuracy of Measurement," by author before the Meter Committee, Missouri Valley Electric Association, Kansas City, April 10, 1946.*

Now Available

for YOUR switchboards



TYPES

AB-13—A-C

DB-13—D-C

VOLTMETERS
A-C & D-C

AMMETERS
A-C & D-C

WATTMETERS

VARMETERS

POWER-FACTOR
METERS

SYNCHROSCOPES

FREQUENCY
METERS

ALSO

Temperature
Meters

Tachometers

LONG SCALE • EASY TO READ • SMALL SIZE • 1% ACCURACY

CONCENTRIC-SCALE instruments

Return with a great war record

Shortly before the war began, production of these instruments had just started. Radically new then—in terms of unusual readability for their small size—they were standardized on Navy installations and served successfully under more severe operating conditions than ever would be encountered in peacetime applications.

Only 4¼ inches square, yet having a scale 7 inches long, these instruments are ideal for large switchgear—they permit packing a lot of circuit information into a small space. They are well suited for console-type equipment where space is at a premium. In fact, they will serve well in practically any permanent or portable installation.

What's more, concentric-scale instruments are unusually sturdy, accurate to within 1 per cent, thoroughly shielded, and have many other excellent features to be found in Bulletin GEA-3432. For your copy, call the nearest G-E sales office. And when you write up your new specifications, call for concentric-scale switchboard instruments. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

HEADQUARTERS FOR MEASUREMENTS

GENERAL ELECTRIC

Excitation Systems for Turbine Generators—I*

M. D. ROSS, *Manager, A. C. Generator Section, Westinghouse Electric Corp., East Pittsburgh, Pa.*

Comparative possibilities in regard to high availability, simplicity and low first cost of four of eight excitation systems

A. SYSTEMS TAKING POWER FROM TURBINE SHAFT

1. DIRECT-CONNECTED EXCITER

a. Lowest installed cost.
b. Not affected by occurrence of system disturbances.
c. Unless a spare exciter is furnished brushes must be changed under load for continuous operation.
d. Requires no outside source of a.c. power to get unit started.
e. Uses regulator of exciter rheostatic type.
f. Mechanical or commutation troubles will cause a shutdown of the unit.

2. DIRECT-CONNECTED EXCITER; NO PILOT

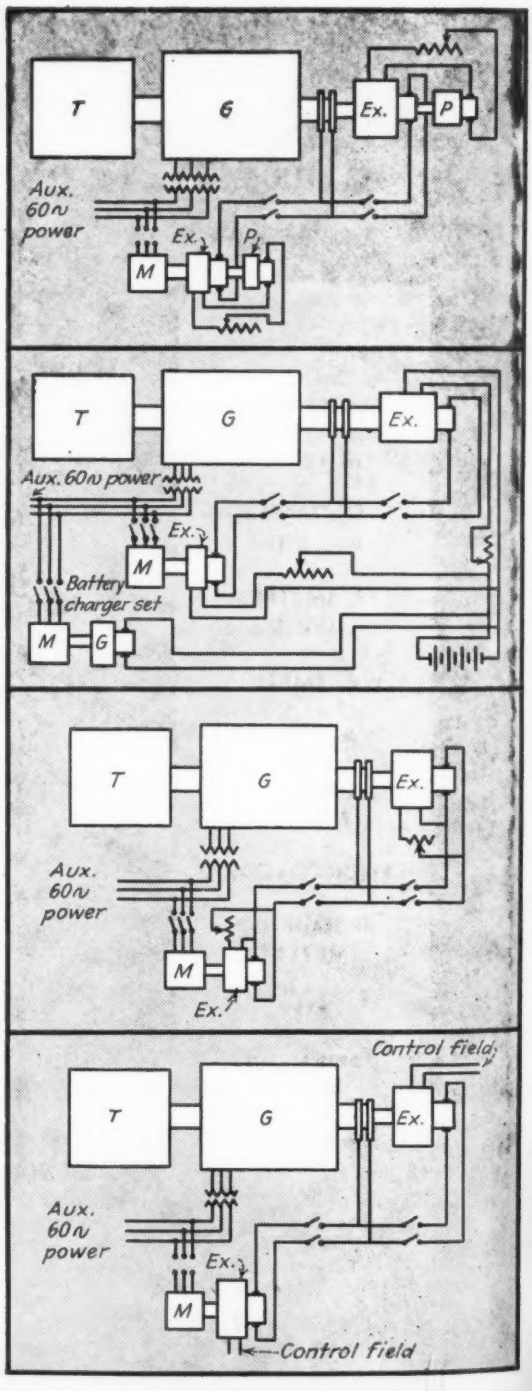
a. Same as A-1 except the pilot exciters are eliminated and excitation taken from the station battery for main exciters.
b. No mechanical problems are involved with this scheme. Battery charging unit can be serviced at any time without interrupting excitation supply.
c. The station battery is more vulnerable so far as interruptions are concerned.
d. The extra cost of the larger battery charger capacity is relatively small.
e. This arrangement works satisfactorily with the exciter rheostatic regulator.

3. SELF-EXCITED EXCITER

a. Same as A-1 except pilot exciter omitted and exciter field energized from its own terminals.
b. Not affected by system disturbances.
c. Unless a spare exciter is furnished brushes must be changed under load for continuous operation.
d. Requires no outside source of a.c. power to get unit started.
e. In generator sizes up to about 15,000 kva. a direct acting regulator is satisfactory. Above 15,000 kva. design of exciter rheostatic regulator is difficult to design as small changes in exciter characteristics involve redesign of rheostat steps.
f. Mechanical or commutation troubles will cause a shutdown of the unit.

4. ROTOTROL EXCITER

a. Same as A-1 except pilot exciter omitted and Rototrol type main exciter provided in which a small control energy source regulates the output voltage of the exciter through a special control field winding.
b. Main exciter is larger than in A-1 as the magnetic circuit must be designed for relatively low saturation.
c. Requires no large rheostats for voltage control. Can be controlled by direct acting regulator or static regulator.
d. Comments b, c, d and f under A-1 apply here also.



* *Adapted from a paper presented before A.I.E.E. winter convention, New York. Other examples, for the same class of excitation system and for systems which obtain power from the main generator itself or its auxiliary power system, will be presented in a subsequent issue.*

Performance

TRANSFORMERS

ROUND COILS IN WOUND CORE
REG. U.S. PAT. OFF.

Why L-M ROUND-WOUND Transformers are Balanced for Maximum Performance

L-M Round-Wound Transformers are designed to provide an overall balance in *all* the electrical characteristics you require in a distribution transformer.

Line Material Company recognizes the fact that a good transformer is a series of compromises. Manufacturers know that it is possible to build a transformer that is exceptional in one or two performance characteristics, but this is done at the expense of some other characteristic equally important to the efficient, economical performance of the transformer.

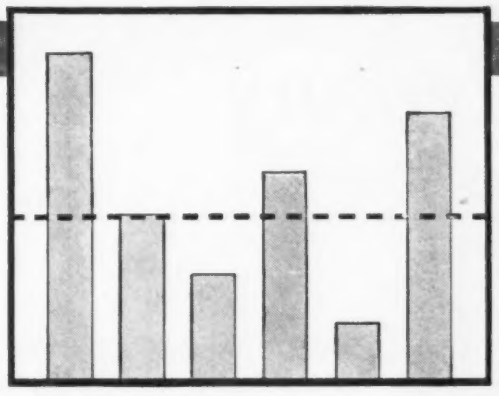
It is known, for example, that the use of excessively large cores will offer exceptionally low exciting current and core loss. The increase in core steel, however, requires the use of a larger mean turn diameter coil, resulting in higher reactance drop, higher impedance, and poorer regulation.

L-M Round-Wound design assures you maximum overall performance without neglecting any important performance characteristic.

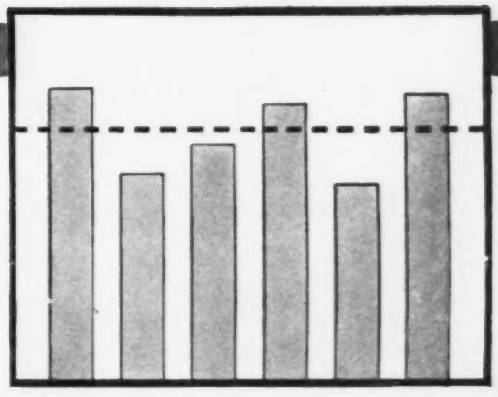
L-M Round-Wound Transformers are made in 1½ to 25 Kva, in all distribution class voltages including 14,400 volts, and meet EEI and NEMA standards.

Get the Whole Story

Ask the L-M Field Engineer for the facts on Round-Wound Transformers; or send for Bulletin RW-421. Write Line Material Company, Transformer Division, Zanesville, Ohio.



"Unbalanced Performance" Some transformers are very good in some characteristics, but less desirable in others. Sacrificing some characteristics in order to get excessively good performance in others results in unbalanced performance.



"Balanced Performance" By careful design and through the advantages of Round-Wound construction, it is possible to get a better balance of characteristics in L-M Round-Wound Transformers. That is what balanced performance means.

These are the Important Characteristics to Balance for Maximum Transformer Performance

Impulse Strength. Round coils permit winding without hammering to shape, eliminating tight corners and risk of damaging the insulation. Result: *higher average impulse strength.*

Short-Time Overload Capacity. Round-Wound construction gives ample circulation of oil in the passages between the cruciform core and the coil, around the exposed coil surface, and through specially designed ducts wound in the coil. This extensive oil circulation assures exceptional cooling. Thus a high short-time overload capacity is gained.

Short Circuit Strength. Short circuits tend to pull rectangular coils into circular shape, which may damage or weaken the coils. Round coils have fundamentally superior strength characteristics; their shape provides maximum short circuit strength, contributing greatly to the long life of Round-Wound Transformers.

Regulation. L-M Round-Wound construction provides lower resistance and reactance drop, resulting in better regulation than conventional rectangular construction. Revenue to the utility is increased because of higher secondary voltage and greater kilowatt hour output.

Loss Ratio. Improved ratio of losses with lower total losses are achieved by L-M Round-Wound design without sacrificing the Round-Wound advantage of low exciting current and improved regulation.

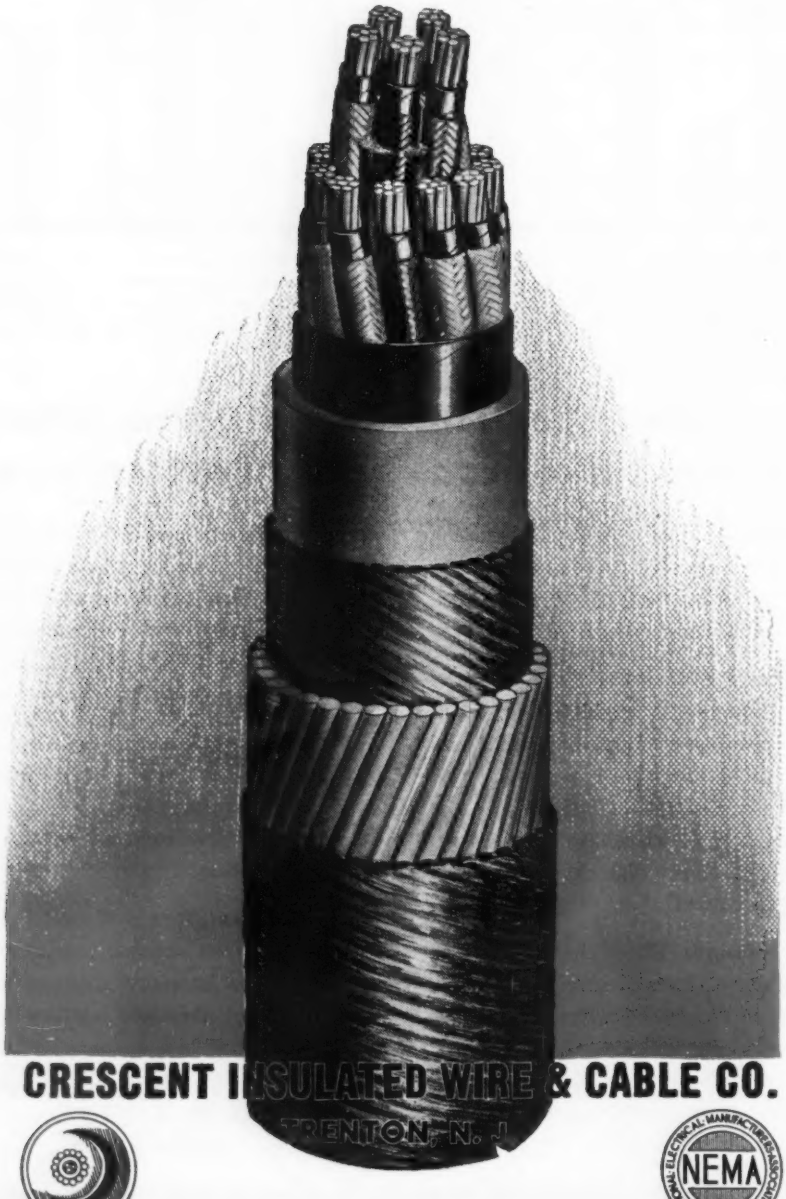
Exciting Current. Round-Wound Transformers permit the lowest exciting current compatible with other performance characteristics. Because exciting current is a wattless current and a direct factor in system capacity, it is an important consideration. Round-Wound core construction offers consistently low exciting current in all ratings.

LM

LINE MATERIAL
TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware •

CRESCENT
WIRES AND CABLES
Serving Industry for More than Half a Century



CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

NEMA

condenser and small carbon filament lamp. The resistor and the condenser are connected in separate leads attached to the same lamp terminal. The third lead is connected to the remaining lamp terminal. Both the resistor and the condenser are housed in a 1⅝-in. bakelite tube 6 in. long, and the lamp base, protected by a wire guard, is mounted in one end. Leads are brought out the opposite end of the tube.

With leads connected to the 240-volt three-phase secondary the lamp burns bright for one direction of phase rotation; remains dark for the opposite rotation.

Illustrations show the indicator assembled and with parts exposed. The design has been standardized for use by all company line crews.

•

Treated Paper Used As Glass Cleaner

A METHOD for making a cleaner for glass and similar surfaces by impregnating paper with a glycerine-silicate combination forms the basis of U. S. Patent 2,386,066, granted to R. M. Schlabach, according to "Glycerine Facts." In the process described, kraft paper is treated with an aqueous solution containing from 75 to 115 cc. of glycerine and 150 g. of silica per liter of water. Following this treatment the paper is dried to evaporate the water and form a product carrying glycerine and silica in the approximate amount of 15 to 20 percent by weight of the untreated paper.

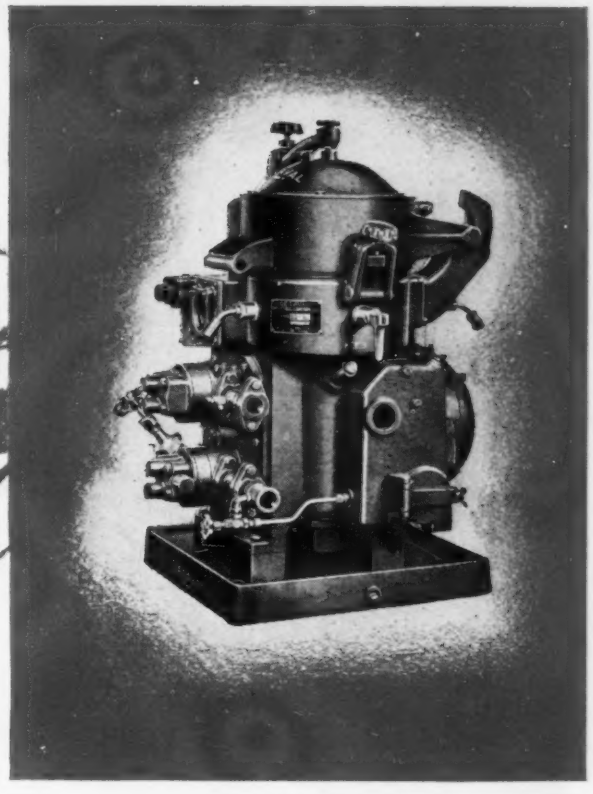
•

Defend Crossing Towers Against Erosion Threat

CHANGES in the channel of the Arkansas River are a constant threat to river-crossing towers on the system of the Arkansas Power & Light Co., north of Pine Bluff. In one of the more recent battles with the river which was fought to a "draw" by the company, engineers resorted to lumber mats and granite rip-rap to keep the river from eating away the bank and undermining tower foundations.

The Arkansas River near Pine Bluff shifted its channel from the north to the south side of the 2,300-ft. river bed, threatening a state highway bridge

GIVE YOUR TURBINE . . .



PROTECT your turbine from ***both*** of the chief causes of lubrication failure—dirt and water. To rid the lubricating oil of dirt only is to give the turbine just ***half*** of the protection it requires.

A De Laval Oil Purifier provides a simple, effective means of insuring against the troubles caused by water and dirt. Its purifying action is instantaneous and wholly mechanical. Foreign material is thrown out by centrifugal force, and this centrifugal force removes from the oil and continuously discharges condensate or other water.

If a turbine protected by a De Laval Oil Purifier should develop a water leak, the excess of water would likewise be removed before damage could be done. There would be no sudden formation of "liver" in the lubrication system.

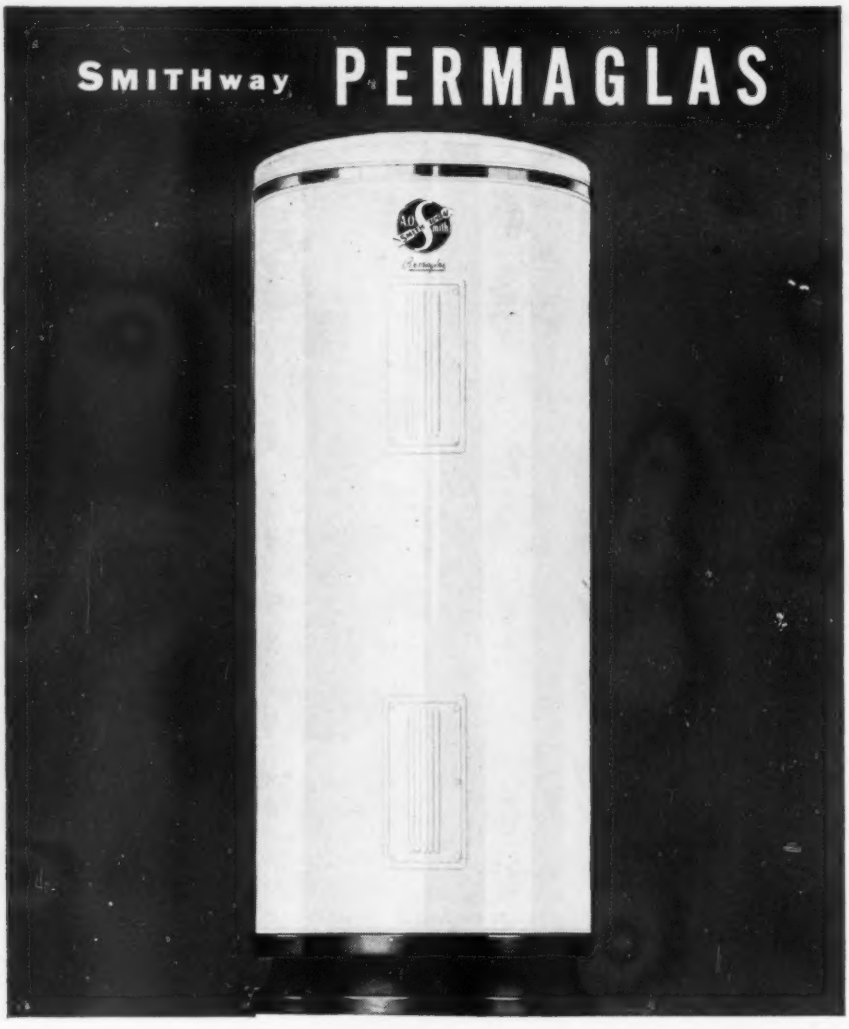
De Laval Oil Purifiers have another inherent advantage—they discharge the purified oil with oil-soluble additives intact.

- Write for Bulletin 400 for details.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

LUBRICATING OIL PURIFIERS



The Water Heater That Set the Style for All Postwar Models

NOTHING mars the trim beauty of the SMITHway *Permaglas* Water Heater. The handsome black Pyramid Base does away with awkward legs. Neotone White Enamel, baked-on-steel, is easy to keep glistening clean. The trim is polished stainless steel.

The *Permaglas* tank, of course, is pure glass-fused-to-steel. Mirror-smooth, sparkling blue, it CANNOT rust or corrode!

Write today for "The Inside Story of Permaglas"—find out why *Permaglas* is a great aid to sales!

HOT WATER BY wire

A. O. SMITH Corporation

SMITHway Permaglas ELECTRIC WATER HEATERS

bed, threatening a state highway bridge and an adjacent 250-ft., double-circuit transmission crossing tower that was set some 50 ft. back from the bank and about 200 ft. below the bridge.

The state highway department had previously rip-rapped the upstream banks and downstream of the river to protect the bridge abutments. But this did not check the erosion of the bank near the towers.

Two specific counter-erosion measures were taken by company engineers

EROSION THREATENS TOWERS—Inroads of erosion occasioned by a shift in the channel of the Arkansas River have been reduced above by installation of lumber mat and rip-rap adjacent to these transmission crossing towers. The 250-ft. tower at left carries 110- and 66-kv. circuits; tower at right 110-kv. circuit

to minimize the threat to the towers. First a mat of lumber was woven and laid out along the bank under water. This mat extends downstream from the bridge about 200 ft. to a point below the tower and runs out into the river a distance of about 100 ft. It has been found that the force of the river will not wash soil out from under such a mat rapidly. Second measure was to rip-rap the bank of the river with granite blocks to prevent flood erosion. Piles had previously been driven in the river bed parallel to the bank to act as baffles and slow the velocity of the water along the bank in the hope that erosive action would be further slowed and that possibly some water-born silt would be deposited.

These defense measures, which are familiar tactics to old river fighters, have been successful in delaying the advance of the river on the tower at

LIGHT DUTY... *But all Truck*

Yes, International Light-Duty Trucks are all-truck. They are designed as trucks, engineered and built as trucks. They're powered by the famous International Green Diamond engine. They make *no* compromise with passenger car construction.

A complete line permits International to recommend the best light-duty truck for any job—best for efficiency, lowest operating cost, longest life.

The name, International, is a warranty of truck quality. That name represents more than 40 years of truck engineering and manufacturing experience.

And here's an unusual record: For the last 15 years more heavy-duty International Trucks have served America's commercial truck transport than any other make.

And here's an unusual service feature—*all-truck* service supplied by the nation's largest company-owned truck service organization, International Branches, and by International Dealers.

For all-truck performance—*International!* For all-truck service—*International!* See your nearby Dealer or Branch.

Motor Truck Division
INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago 1, Illinois

Tune in "Harvest of Stars" Sunday, 2 p.m. Eastern Daylight Time, NBC Network

Pickup

Panel Body

Panel Stake

Other International Harvester Products:
FARM POWER AND EQUIPMENT
INDUSTRIAL POWER • REFRIGERATION

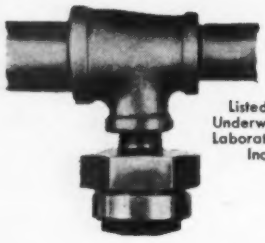
Dump Truck

Multi-Stop Delivery

Tractor and Semi-Trailer

School Bus

INTERNATIONAL TRUCKS



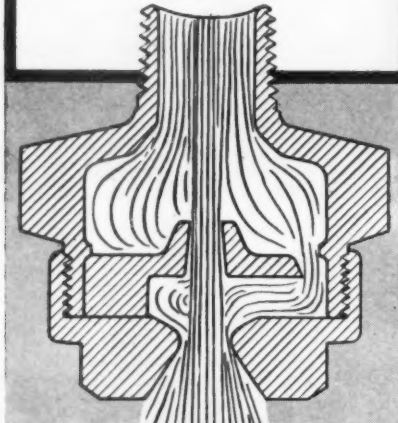
Listed by Underwriters Laboratories, Inc.

This is how the

BLAW-KNOX

Aquatomic

FOG NOZZLE FIGHTS FIRE



IN TRANSFORMERS, FLAMMABLE LIQUIDS AND STORAGE TANKS

The *Aquatomic Fog Nozzle* creates a cone of atomized water particles having force enough to reach to the base of the fire in spite of air turbulence and drafts.

At the same time, these particles are fine enough to give a maximum cooling and quenching effect, and are so well separated as to prevent conduction of electric currents.

The spray pattern is maintained even with reduced pressures. Clear passages in the nozzle prevent clogging.

Also—

Standard Wet and Dry Pipe Systems, as well as Thermostatically Controlled Pre-Action and Deluge Systems.

Write for details

BLAW-KNOX

SPRINKLER DIVISION

829 Beaver Avenue, N. S., Pittsburgh 12, Penna.

least until some subsequent whim of the river will again shift the channel away from the threatened bank.

•

Balls Act as Gasket Compression Stops

O. E. FAWCETT
Maintenance Engineer
West Penn Power Co., Pittsburgh

ONE SIMPLE WAY of making sure that Corprene gaskets are compressed to tightness but not compressed beyond their resilient limit is to use steel balls as stops. Thus, a set of four $\frac{3}{16}$-in. steel balls set in four equidistant holes in a $\frac{1}{4}$-in. thick gasket will resist the tightening of the bolts after a one-fourth compression has been applied to the gasket.

•

Door-Type Guard Prevents Ladder Climbing

A WOODEN door-type guard serves to "lock" a ladder and effectively discourages boys or other adventurous persons who might climb to the top and expose themselves to injury.

This form of protective device is built as a door, is hinged to one side piece of the ladder and padlocked to the other sidepiece. The guard is mounted so that the bottom edge is about even with the sixth rung from the foot of the ladder and closes over the next five higher rungs. This installation was made on a ladder which was permanently attached to a cooling tower of a southern utility company.

•

Cost of Auxiliary Street Light Switches

(These data from the work sheets of an eastern utility apply to the equipment of isolated street lighting circuits with Colt switches. Circuits under time clock control.)

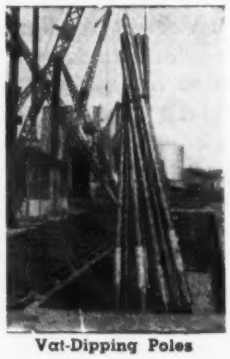
17 auxiliary switches	$53.01
23 dowels	1.26
Stores supplies	7.36
Stove bolts	0.54
Express	1.16
Insurance, etc	3.35
Labor	77.94
Superintendence	5.90
Use of truck	22.40
No. 8, two-conductor overhead service cable, 103 lb.	39.99
No. 10, two-conductor fixture cable, 10 lb	4.92
7 Duplex brackets	6.12
25 Brackets (33750-P)	3.95
33 Connectors	2.87
Duxseal, 7 lb.	1.05
TOTAL	231.82

PERMATOX "A" makes poles last longer

Poles treated with PERMATOX "A" insure *longer* service life and *lower* maintenance cost.

PERMATOX "A", applied by pressure treatment or vat soaking, effectively controls shell-rot, decay and attack of termites or Lyctus (powder-post) Beetles in posts, poles, cross-arms, timbers and other wood construction.

Reclaim old poles by trimming away rotted portions and treating with PERMATOX "A". *Write for details of treating methods.*



Vat-Dipping Poles

Furnished in Two Forms:—

DOWICIDE 7

Pentachlorphenol* crystals

PERMATOX "A"

5% Pentachlorphenol in suitable petroleum solvents.

* Manufactured by The Dow Chemical Company

Write for Bulletin—Dept. E.

CHAPMAN CHEMICAL CO.

Formerly A. D. Chapman & Company, Inc.

333 N. Michigan Avenue, Dept. E
Chicago 1, Illinois

CHARLOTTE HOUSTON LOS ANGELES MEMPHIS PORTLAND NEW ORLEANS NEW YORK

putting termites out of your business

For reliable protection against destroying organisms, the lumber and woodworking industries—like many other enterprises—have found true effectiveness in Dowicide.

When saws transform trees into lumber, wood destruction starts. It can be prevented by Dowicide 7 (Dow Pentachlorphenol), a tested preservative that forestalls damage by mold, decay and termites.

Pentachlorphenol is only very slightly soluble in water and its volatility is extremely low. Hence it affords protection that lasts. And it is highly toxic to practically all fungi, bacteria and other microorganisms. Yet wood treated with pentachlorphenol is clean and paintable, nonbleeding, easily handled.

Dow is prepared to supply pentachlorphenol in quantity and counsel you on its use. Try pentachlorphenol for wood preservation—try Dowicides to halt destruction by organisms in any industry.

DOWICIDE

germicides and fungicides

control termites mold and bacteria

DOWICIDES IN THE ELECTRICAL INDUSTRY

Effective preservative treatment of wood poles and cross arms is attainable with Dowicide 7 (Pentachlorphenol). Impregnation is achieved by heating the wood, followed by a cold bath in a pentachlorphenol solution. Dowicides also protect cotton braid covering and jute roving from dry rot and mold in overhead and underground cable installations.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

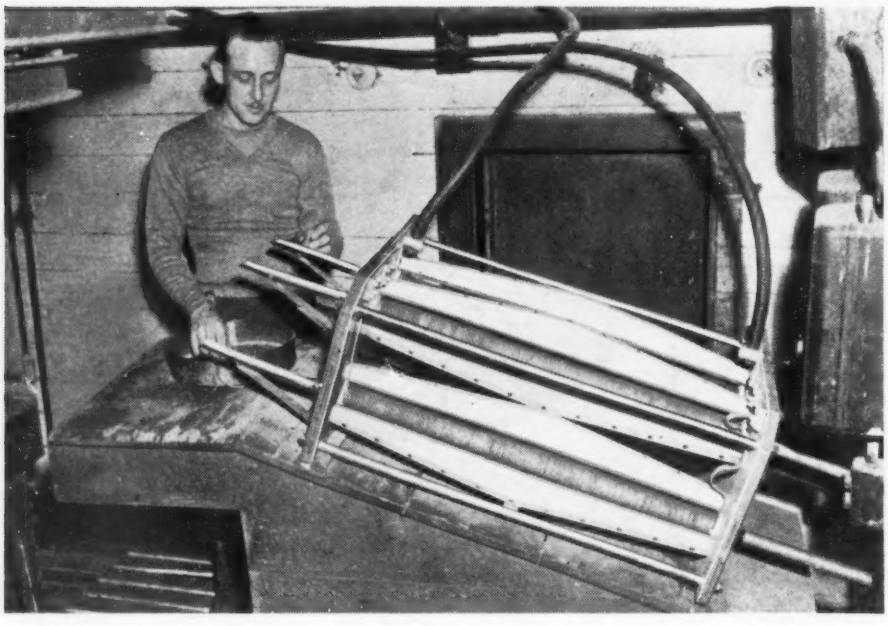
New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

LOAD BUILDING

Low Cycle Heater Drys Metal Plugs Fast



SIXTY-CYCLE INDUCTION HEATER—Tapped plugs leaving a bonderizing bath are dried inside and out as they pass through the four tubes of this 60-cycle induction heater. The heater at full capacity can handle 7,500 parts per hr. Load is 6,700 watts at 42 percent power factor. The four coils operate in parallel across 22 volts on the secondary of a single-phase transformer.

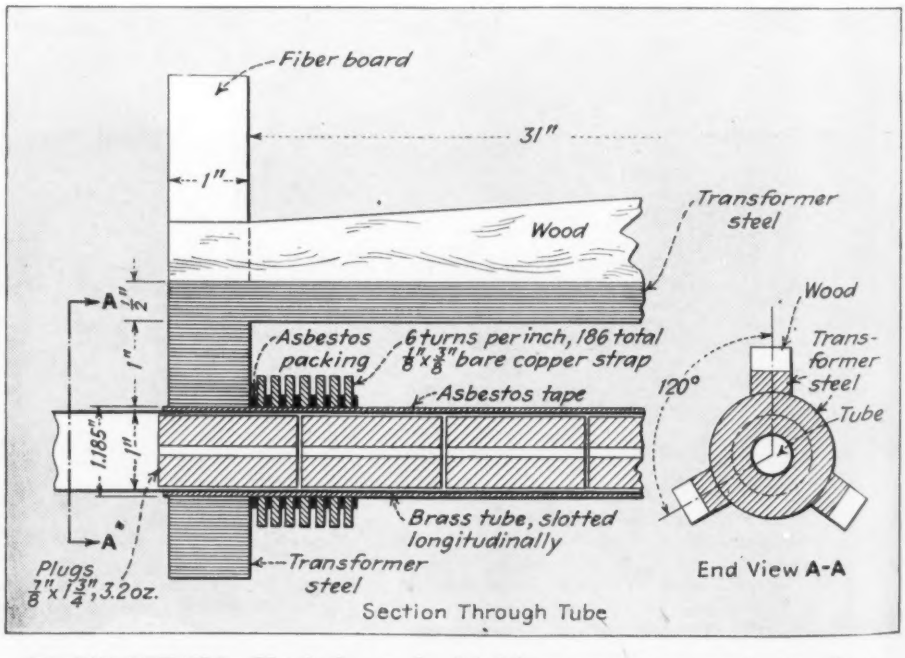
C. D. MALLOCH
and O. R. EICHENBERGER
Power Sales Dept., Consumers Power Co.
Jackson, Mich.

A CUSTOM-BUILT 60-cycle induction heater of simple design has recently been used effectively to dry metal "plugs" after bonderizing at a manufacturing plant in Adrian, Mich. This unit, shown, displaced a hot chemical bath when the need arose for higher production rate than could be handled with the existing drying method. The induction heater is capable of a sustained production rate of 7,500 parts per hour (1,500 lb. of metal). Output of the previous method was only 1,000 parts per hour, many of which were rejects.

Problem of drying the plug was complicated by the presence of a small caliber hole through its center. Also the high mass per unit of surface area of the plug (it was $1\frac{3}{4}$ in. long, $\frac{7}{8}$ in. in diameter and weighed 3.2 oz.) imposed a further handicap on convection and radiant drying methods. This high ratio, however, was in the favor of induction heating because of the inherent capacity of this method for concentrating heat in a limited mass.

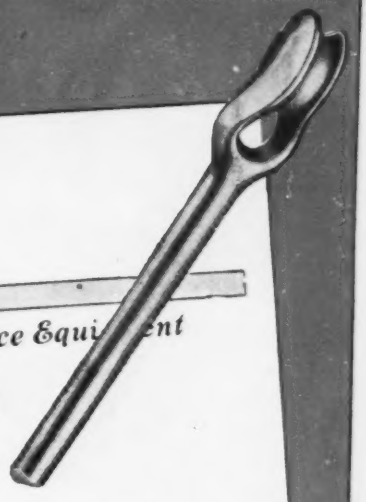
To dry the plug properly after removal from the bonderizing bath, at about 135 deg., it was necessary to raise its temperature above 212 deg. but keep it under 250 deg. Cursory laboratory tests indicated that this temperature rise could be attained quickly enough by using the plugs as part of the short-circuited secondary of a "transformer" the primary of which was supplied with a proper 60-cycle potential.

Details of the heater design evolved are indicated in the accompanying drawing which shows a longitudinal section through one of the four identical operating elements that make up the device. Each of these operating elements consist of 186 turns of bare copper strap wound edgewise along the outside of a 1-in. dia. by 33-in. long longitudinally slotted brass tube



DESIGN DETAILS—Metal plugs to be dried form common return leg for three equally spaced outer legs of a steel magnetic circuit linked by the "work" coil. Plugs pass through longitudinally slotted brass tube around which work coil is wound. Rate, 27 plugs per min.; temperature raised 90 deg. F.

What About the Anchor Situation . . .



A·B·CHANCE CO.

Line Construction and Maintenance Equipment

OFFICES
NEW YORK
CHICAGO
DALLAS
KANSAS CITY
ATLANTA

210 N. ALLEN STREET
CENTRALIA, MISSOURI

Dear Customers and Friends:

Although we are manufacturing more than three times the number of anchors that we produced before the war, we find it impossible to ship orders promptly. In fact it is still necessary, in most cases, for us to accept quantity orders for delivery in several months.

However, we are optimistic about the situation because our production records indicate that once the backlog of orders is disposed of, we will be in a position to furnish more anchors annually than were used by both the electrical and communications industries in any pre-war year

The requirements of the Armed Forces during the war, made it necessary for us to expand our facilities to the extent that we now produce more anchors in four months than we previously manufactured in a year.

In 1946 we will produce more than a million and a half Steel Expanding Anchors. Our production of Never-Creep Anchors, Screw Anchors, Rock Anchors, and other types has increased proportionately. We are overcoming the heavy backlog and, although our delivery promises are still far from good, prospects are exceptionally favorable for considerable improvement in our deliveries.

What we did for Uncle Sam, we can also do for you, but we need your cooperation. You can help the situation by placing your orders with your regular source of supply only. Placing duplicate orders will complicate matters, tie up stocks, and delay deliveries.

Yours very truly,

F. Lane Chance

President.

…E ANCHOR RODS
…NDING EQUIPMENT

THIMBLEYE GUY FIXTURES
TIPS TAP CLAMPS

CONSTRUCTION TOOLS
TIPS FUSED TAPPERS

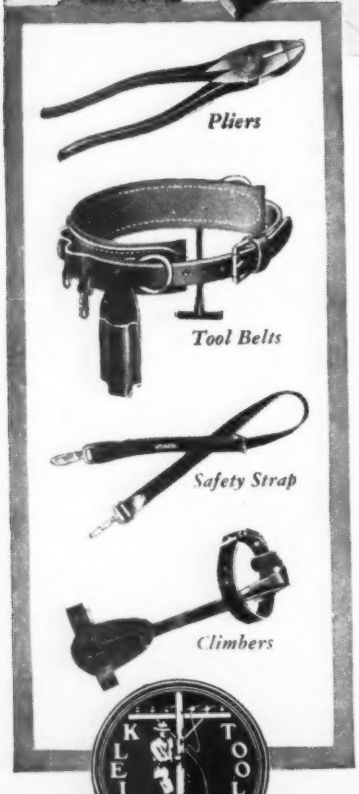
CHANCE CABLE CARS
SWITCHES CUTOUTS

PUBLIC UTILITIES SINCE 1907

A·B·CHANCE CO.

CENTRALIA, MISSOURI. SAN FRANCISCO, CALIFORNIA

ABC INDUSTRIES



If you've ever worked on a pole fifty feet off the ground—you know why linemen prefer equipment bearing the familiar Klein trademark. For instance:

KLEIN CLIMBERS take him up and down the pole safely—provide sure footing while he works.
"KLEIN-KORD" SAFETY STRAPS provide maximum safety on every job—the Red Center unmistakably signals when the strap should be replaced.
"KLEIN-KORD" TOOL BELTS give the safety, comfort and convenience needed for fast, efficient work.
KLEIN PLIERS help him do any wiring job better and quicker.

The widespread preference for Klein tools and equipment has been developed over the years. "Since 1857," Mathias Klein & Sons has built its reputation on fine craftsmanship and quality materials.

Today, although the full Klein line is in production, demand exceeds supply. However, your supplier will fill your order as soon as possible.

ASK YOUR SUPPLIER
Foreign Distributor:
International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 **Chicago, Ill., U.S.A.**
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

that is insulated with asbestos tape. Turns of the coil are separated with asbestos packing. Ends of the brass tube are encircled by 1-in. thick "doughnuts" of transformer steel (I.D. 1 in.; O.D. 2 in.) which are linked at three equidistant points around their circumference by builtup "bars" of transformer steel having a ½- x 1-in. section. Thus, when the brass tube is filled with plugs from end to end, they form the common return leg for three outer legs of the magnetic circuit linked by the primary or "work" coil. With the work coil energized, current induced in the plugs is sufficient to raise their temperature about 90 deg. when they pass through the tube at the rate of 27 per minute. Each piece is in the tube about 39 seconds, from the time it enters one end until it leaves the other.

As noted, four identical tube and coil assemblies comprise the unit. The primary or work coils encircling these four tubes are connected in parallel to the secondary of a 20-kva., single-phase, 220/32-volt, dry-type transformer, the secondary of which has six 2-volt taps. The induction heater is operated from the 22-volt tap. Load drawn by the primary of the supply transformer, with the heater in full operation, is 6,700 watts at 42 percent power factor. Estimated efficiency of the heater is 60 percent. Test indicate that it produces a heat release within the work of about 82 watts per cu. in.

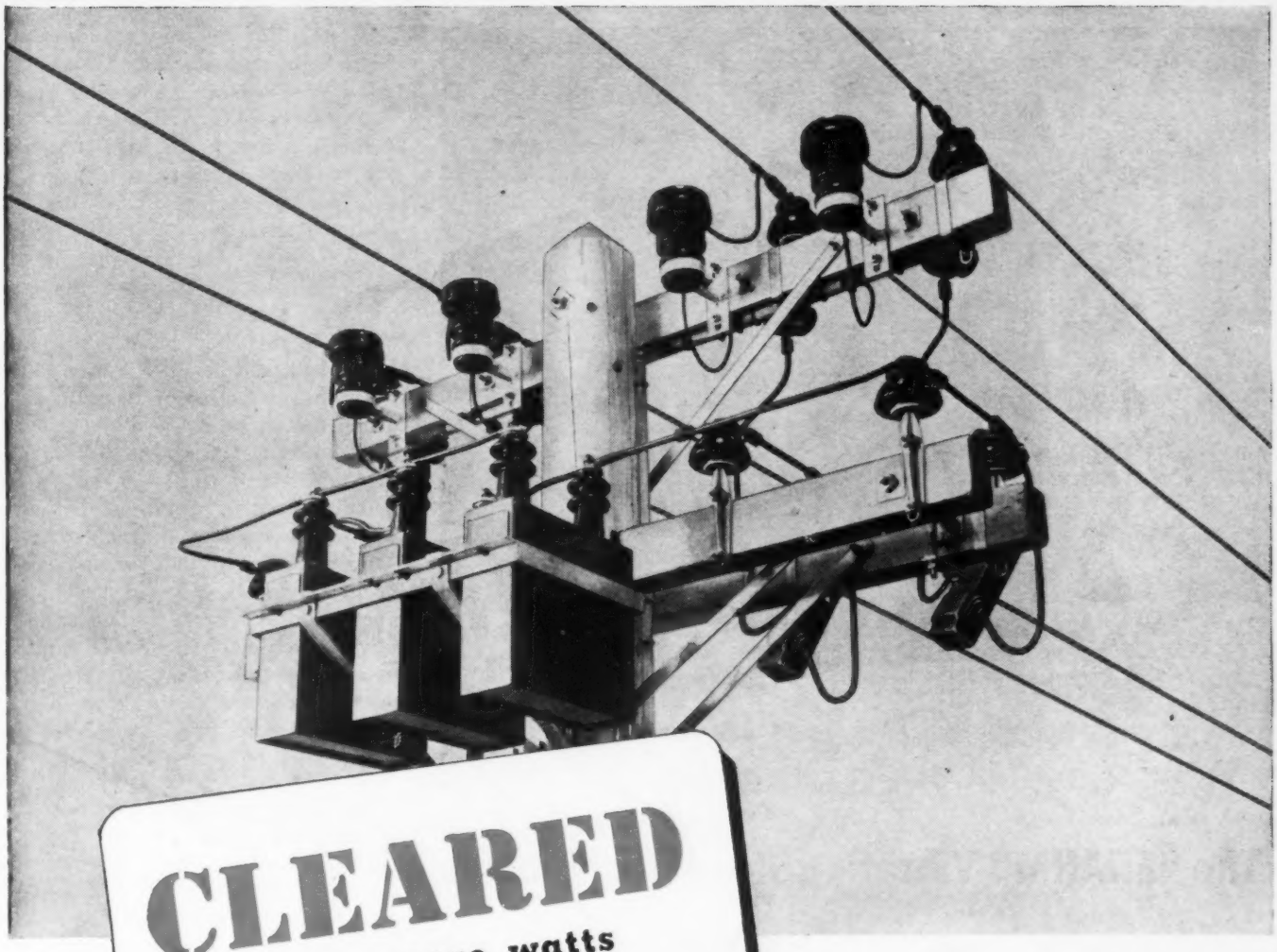
•

Laundry Gains Space By Purchasing Power

J. B. WHITE, JR.
Duquesne Light Co., Pittsburgh, Pa.

ONE of the several benefits obtained by the Budget Laundry Company, Pittsburgh, Pa., when Duquesne Light Co. service replaced steam engine driven generators, was the release of valuable floor space. Electricity for light and power was formerly supplied from two generators which required about 700 sq. ft. of floor area for the engines, generators and accessories. This equipment has been removed and the space is now used for two purposes. Part of the space was converted into a storage room for supplies. A work bench was built in the other part, which is also used to store piping.

In addition to securing additional floor space by removing the electric



CLEARED

...for more watts

with Westinghouse Capacitors

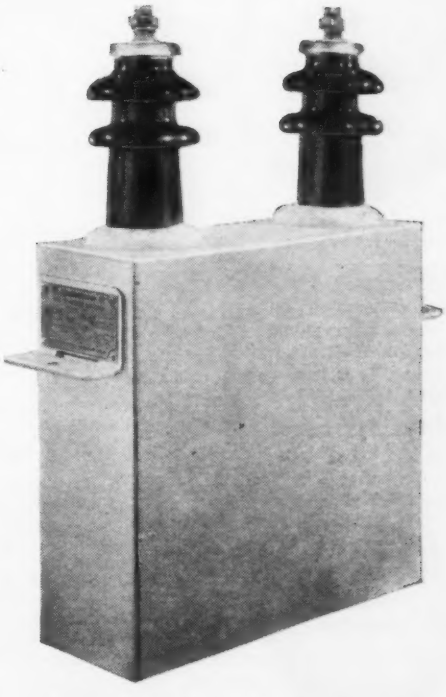
Here's the way to solve these residential distribution problems:

1. When low power factor resulting from increased use of inductive apparatus—ventilating, air conditioning, laundry equipment—has loaded your system to the limit with "wattless", out of proportion to your pay load.
2. When the increasing load is demanding capital investment in additional distribution facilities.

Improving power factor with Westinghouse Inerteen Capacitors will limit the load to revenue-producing current . . . release wasted circuit capacity for additional load . . . reduce the kva demand and line losses (I^2R) . . . improve voltage regulation.

Westinghouse application engineers are ready to serve by checking on benefits you will derive by installing capacitors. It will save money to investigate. Call your Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60638



Westinghouse pole type capacitors offer many advantages. Exclusive Solder-Sealed bushings eliminate need for gaskets and with the all-welded steel case, form a completely hermetically-sealed unit. They are heavily zinc-spray finished to give effective protection against rust, abrasion and atmospheric corrosion . . . thus insuring longer life and minimum replacement costs.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Capacitors

Using a hand type Frahm Tachometer on a Wright Cyclone aircraft engine.

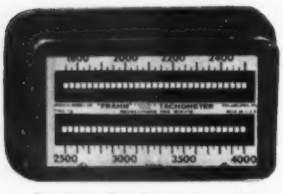
EQUALLY DEPENDABLE

For Portable Use . . .

For Permanent Mounting

The "FRAHM" Vibrating Reed Tachometer

Frahm Tachometer, for permanent mounting.



Frahm Tachometer in splash-proof case for permanent mounting.

Frahm Tachometer, Miniature type.

Because the Frahm Tachometer requires no direct contact with the rotating part whose speed it is measuring, it can be used in practically any position and on almost any machine, large or small. Permanently mounted on or simply held against the machine, it gives the same dependable indications. It functions faithfully year after year. There are no delicate parts—no springs, jeweled bearings, pivots, weights, magnets or electrical connections—nothing except a set of steel reeds, accurately calibrated and suitably mounted.

Frahm Tachometers are furnished in both stationary and portable types, in round and rectangular cases and in many ranges from as low as 900 to as high as 100,000 rpm. For a description of these unique instruments, together with list of types and ranges commonly supplied, write for new Bulletin 1810-W.

JAMES G. BIDDLE CO. • 1316 Arch Street Philadelphia 7, Pa.

generators, the company reduced operating costs and eliminated expensive shutdowns formerly caused by breakdowns.

In discussing purchased electric service, W. R. Stepp, general manager of the laundry company, had the following to say:

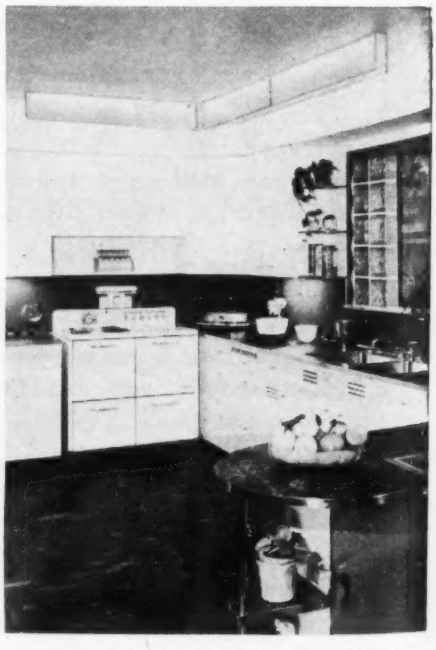
"We are certainly glad that we discontinued the operation of the electric generators. Your service (Duquesne Light) has been economical, convenient, and flexible. For instance, we have a dry cleaning department in which the operation is quite seasonal and sometimes it is necessary to run that department when the rest of the laundry is not in operation. Formerly we had to operate the generator to furnish power to that single department. Obviously, it was inefficient and uneconomical. Now, with purchased service, we use only the power required to run the department. By removing the electric generators we also secured urgently needed floor space. We are well pleased with the change."

•

Kitchen Fixture Is Semi-Shielded

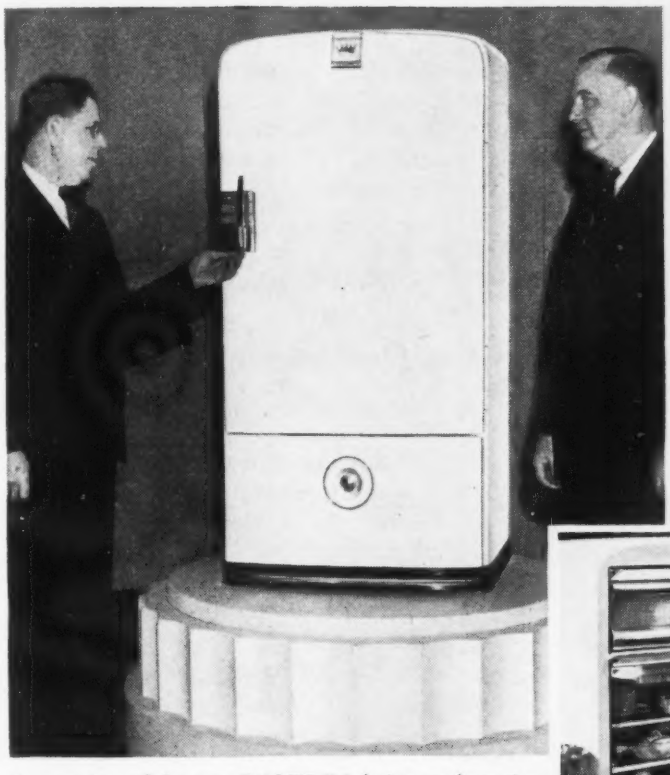
NOVELTY and good performance are combined in the lighting designed by engineers of Sylvania Electric Products, Inc., for a display kitchen recently installed in the store of Lewis & Conger, New York City.

Principal feature is the ceiling light-



KITCHEN LIGHTING INSTALLATION designed to provide 70 foot-candles of shadowless lighting on work surfaces

NOW—The great new Frigidaire Cold-Wall is here



Presentation of the new Cold-Wall is being made to the dealer organization through meetings from coast to coast. Here, M. M. Roberts, Works Mgr., and H. F. Lehman, Asst. Gen. Sales Mgr., discuss one of the new Cold-Wall models.

● The world's most advanced refrigerator before the war is even greater now. It's the Frigidaire Cold-Wall with new, important features and more conveniences than ever before. It's the refrigerator with the right *kind* of cold for every *kind* of food!

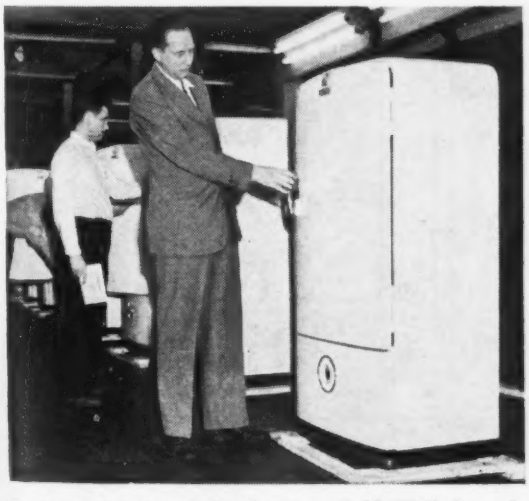
Moist-Cold for storing fresh foods and leftovers without covering of any kind . . . the new Frigidaire Cold-Wall provides it. *Super-Moist Cold* for lots of fresh fruits and vegetables . . . the new Frigidaire Cold-Wall has it. *Freezing-Cold* for frozen foods, desserts, ice cubes...it's there in the new Frigidaire Cold-Wall.

And, now, there's *Positive Humidity Control* with the new Moist-Minder and Dew-Fresh Seal. It's another Frigidaire *first*. It takes its place with the original Cold-Wall of 1939 . . . the *first* practical application to household refrigerators of direct cooling by *chilling coils in the walls*. And with it, there are aluminum rustproof shelves; new, modern styling, and many other new selling appeals of the kind that have made Frigidaire America's favorite.

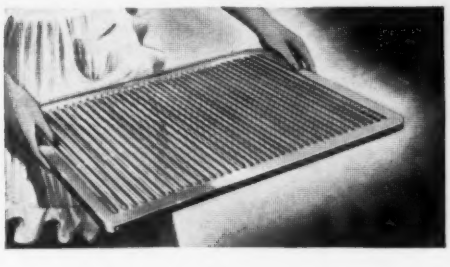
Yet, all these advancements are commonplace at Frigidaire. They are the things that Frigidaire dealers look for and know they will get, for long, long ago Frigidaire Dealers learned that they could always . . . Depend On Frigidaire To Do Things Right!

The Moist-Cold of the Cold-Wall food compartment keeps food fresh without covering. Two Super-Moist Hydrators provide super-moist cold air for fruits and vegetables.

The Super-Freezer Chest of the Frigidaire Cold-Wall provides ample freezing-cold for all frozen storage requirements.



Final Examination of the first new Cold-Walls is made by J. W. Krueger, General Superintendent, Plant No. 2, at Dayton. Rigid specifications and requirements for high-quality workmanship are a "must" at Frigidaire.

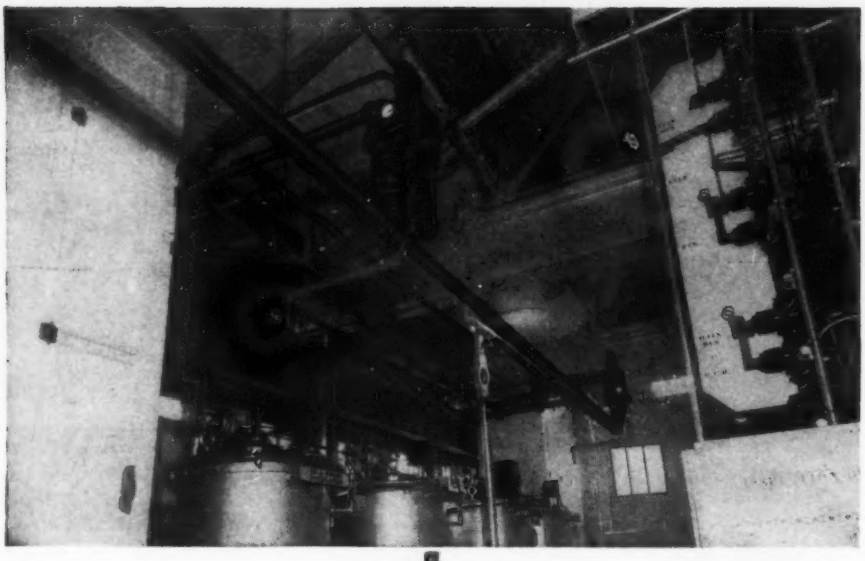


Aluminum Shelves are a new feature in the Frigidaire Cold-Wall. Light-weight, rustproof, they meet the demand of housewives.

Depend on **FRIGIDAIRE** *to do things* **RIGHT!**

You're twice as sure with two great names

Frigidaire made only by General Motors



REGULATED "Automatic" PROTECTION

FIRE-FOG

• IT BLANKETS • IT ISOLATES • IT QUENCHES •

FOR VOLTAGE REGULATORS

Oil-filled electrical equipment such as transformers, voltage regulators, switches and the like demand regulated fire protection at all times.

These electrical installations are the work-horses of industry. Their failure can well spell the break-down in the continuity of plant production.

Far-sighted engineers are demanding "Automatic" FIRE-FOG protection for all types of flammable liquid fire hazards. They know well, the amazing effectiveness of this automatic . . . quick action fire quenching water spray and the results of this protection are written into the records of all leading Fire Insurance Bureaus.

Investigate the advantages of "Automatic" FIRE-FOG protection for your specific fire protection problem. There's no obligation.

THE SUPROTEX® SPRINKLER SYSTEM

—a famous member of the "Automatic Sprinkler Family. Designed particularly for use in manufacturing, mercantiles, warehouses, schools, churches, offices, hospitals, piers and other establishments where positive fire protection is essential.

®Trademark Registered U. S. Patent Office

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 37 CITIES

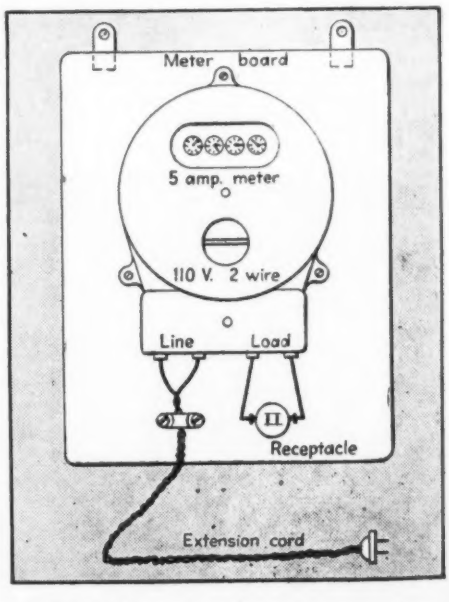
"Automatic" Sprinkler designs, manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories

ing, following the line of the work surfaces below and consisting of two semi-recessed, semi-shielded fixtures, one 4 ft. long, containing one 40-watt standard white fluorescent lamp; the other fixture is 8 ft. long and contains two 40-watt tubes. The fixtures are simple, just ribbed glass strips hung on the sides of the tubes. Supplementing the ceiling lighting are three 20-watt fluorescent lamps installed under the cabinets. With all lights on, illumination on working surfaces is 70 foot candles, half of that with the ceiling lights only.

•

A Check Meter Developed For Farm Use

FREQUENTLY farm customers have occasion to determine how much electricity is being used by various pieces of electrical equipment on the farm. The farm service department of Northern States Power Co., Minneapolis, suggests that obsolete watthour meters may be purchased and arranged as



WITH this meter farmer can measure energy used by farm equipment at various locations

shown. When mounted on a meter board with the extension cord on the line side and receptacle on the load side the device can be carried from point to point on the farmstead and hung conveniently for measuring 110-volt service.

TO MODERNIZE *NOW...*

with new ROEBLING Power Cables

There's stepped-up efficiency in these 4 advantages...

Now—by retiring old, obsolete cables in favor of modern Roebling Power Cables—you can again realize important operating economies:

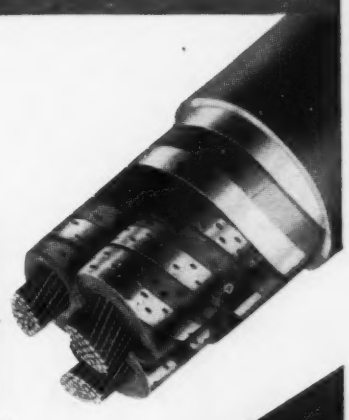
1. **Reduce dielectric losses brought on by aging**
2. **Minimize the danger of service failures**
3. **Increase current carrying capacity**
4. **Benefit from today's improved cable design**

Whether you're modernizing your systems or extending your lines into new areas, Roebling Cables fit equally well into the picture...with their correctly engineered dependability, long service life.

Constant research and development, good materials, scrupulous care in manufacture, experienced engineering skill—all are joined at Roebling to provide the utmost in efficient, low-cost cable service.

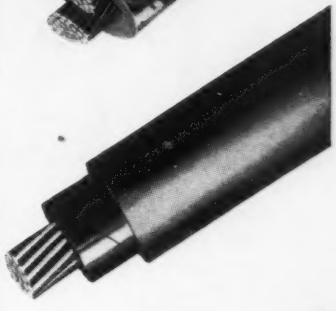
And to help you select what's best for your purpose, a Roebling field engineer's specialized cable knowledge is always available. Call our nearest branch office... he'll gladly serve you.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities



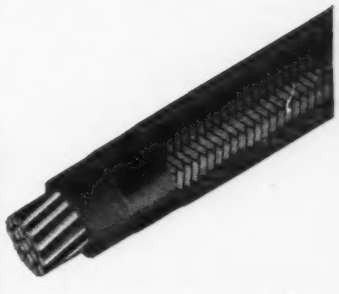
ROEBLING PAPER INSULATED SHIELDED (TYPE H) CABLE

A "solid" type cable used mainly for underground transmission, distribution or service circuits—particularly for 3-phase grounded neutral circuits at from 13 to 33 kv.



ROEBLING VARNISHED CAMBRIC INSULATED CABLE

For power, heat or lighting circuits in central and sub-stations, mines and plants... for generator and motor leads, transformer, and oil switch leads... to operate at voltages up to 26,000.



ROEBLING RUBBER INSULATED POWER CABLE

Designed for operation up to 15,000 volts in power and light circuits and as apparatus leads. Made in moisture-resistant, flame retardant, weather-proof, oil-resisting and other special finishes.

BLING

JR ROEBLING

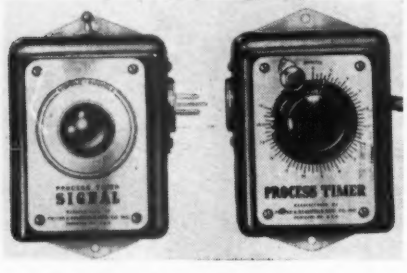
WIRES AND CABLES

NEW EQUIPMENT

Process Control Timer Synchronous Motor Driven

A SYNCHRONOUS utility process timer, Type TA, which is applicable to molding, electronic heating, plating, photography, chemical processing, heat treating, cooking, drying, aging, etc., is being announced by Potter & Brumfield Sales Co., 549 West Washington Blvd., Chicago 6, Ill.

The unit is powered by an instantaneous starting synchronous motor which actuates a pair of snap-acting silver contacts rated at 1,000 watts. A single 3-way outlet mounted on the side of the Bakelite case permits connection to the load for "on during cycle"



or "off during cycle and come on at end of cycle." The unit, which operates in any position, has standard time cycles of from 0 to 15, 0 to 30, and 0 to 60 minutes and 0 to 12 hours. Other time cycles are available as specials.

A companion piece to this unit is the Type A signal indicator. It also is housed in a Bakelite case and contains both a buzzer and indicating bullseye light. It plugs into the timer unit or can be remotely located by use of a 3-wire cord.

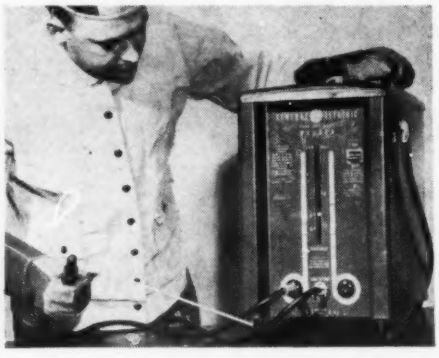
•

Farm Welder Scale Calibrated In Electrode Size, Not Amp.

A NEW a.c. farm and home arc welder especially designed for operation on single-phase lines of limited capacity supplying rural areas and small communities has been announced by the General Electric Co., Schenectady 5, N. Y. It is reported to conform to NEMA standards and E.E.I. and REA requirements for farm welders.

It is made in two ratings, 130 and 180 amp., either with or without capacitors. It has two plug-in connections for the electrode cable, one for use with $\frac{1}{16}$-in. or $\frac{5}{64}$-in. electrodes and one for $\frac{3}{32}$-in., $\frac{1}{8}$-in., and, in the larger rating, $\frac{5}{32}$-in. electrodes.

A welding current scale located on the front of the welder is calibrated in electrode sizes rather than in amperes. Current adjustments are made by means of a hand crank which provides an infinite number of settings to accommodate the size electrode being used. A gage consisting of a



series of calibrated notches on the bottom edge of the front panel makes possible quick identification of electrode size.

Included are 15 ft. of electrode cable complete with plug connector and fully insulated electrode holder, 10 ft. of ground cable connected to the welder with ground clamp attached, 10 ft. of primary cable with a three-prong plug attached, and a wall receptacle.

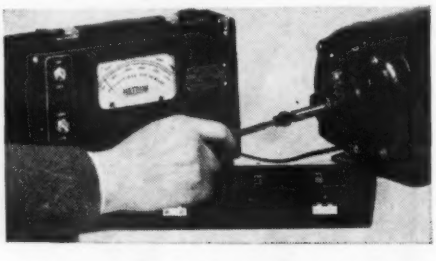
•

New Tachometer Aids Overspeed Trip-Out Testing

SYNCHRONOUS-SPEED tachometer for measuring speeds at approximately the two synchronous speeds of 1,800 and 3,600 rpm. and used for overspeed trip-out testing of turbo-generators, production testing of electric motors, motor efficiency tests, motor overload tests, and other tests at or near synchronous speeds is being announced by Metron Instrument Co., 432 Lincoln St., Denver 9, Colo.

It is available in three types—type 48A for speeds above synchronism, 48B for speeds below synchronism, and 48C which has an equal spread above and below synchronism.

The head of the tachometers is a simple contact-making mechanism operated by rotation of the spindle. This mechanism periodically charges a condenser through a d. c.



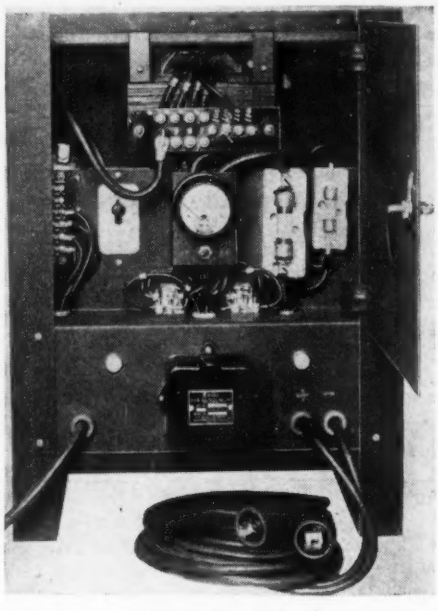
milliameter which indicates average current. Scales are linear and unit has a reported accuracy of $\frac{1}{4}$ of 1 percent.

Operation is from a 115-volt a.c. power line. The unit is reported as simple to operate through the two controls—an off-on switch and a high-low range switch.

Battery Charger Provides Unattended Service

AN AUTOMATIC two-rate industrial truck battery charger to provide rapid, unattended charging for either lead-acid or Edison type batteries has been designed by Federal Telephone and Radio Corp., Newark, N. J. The charger, known as FTR 9202-AS, operates on a 105-125-volt, single-phase, 60-cycle circuit. It will charge six-cell, 250-ampere-hour, lead-acid batteries to full capacity in eight hours and the ten-cell, 250-ampere-hour Edison batteries in seven hours, the company reports.

The operation of the unit is reported as simple. A toggle switch located inside the



door to the cabinet determines the method of charge control. To operate, clip the charging leads to the battery, turn the switch to select the desired charging cycle, then turn the time switch to the number of hours required for the charge.

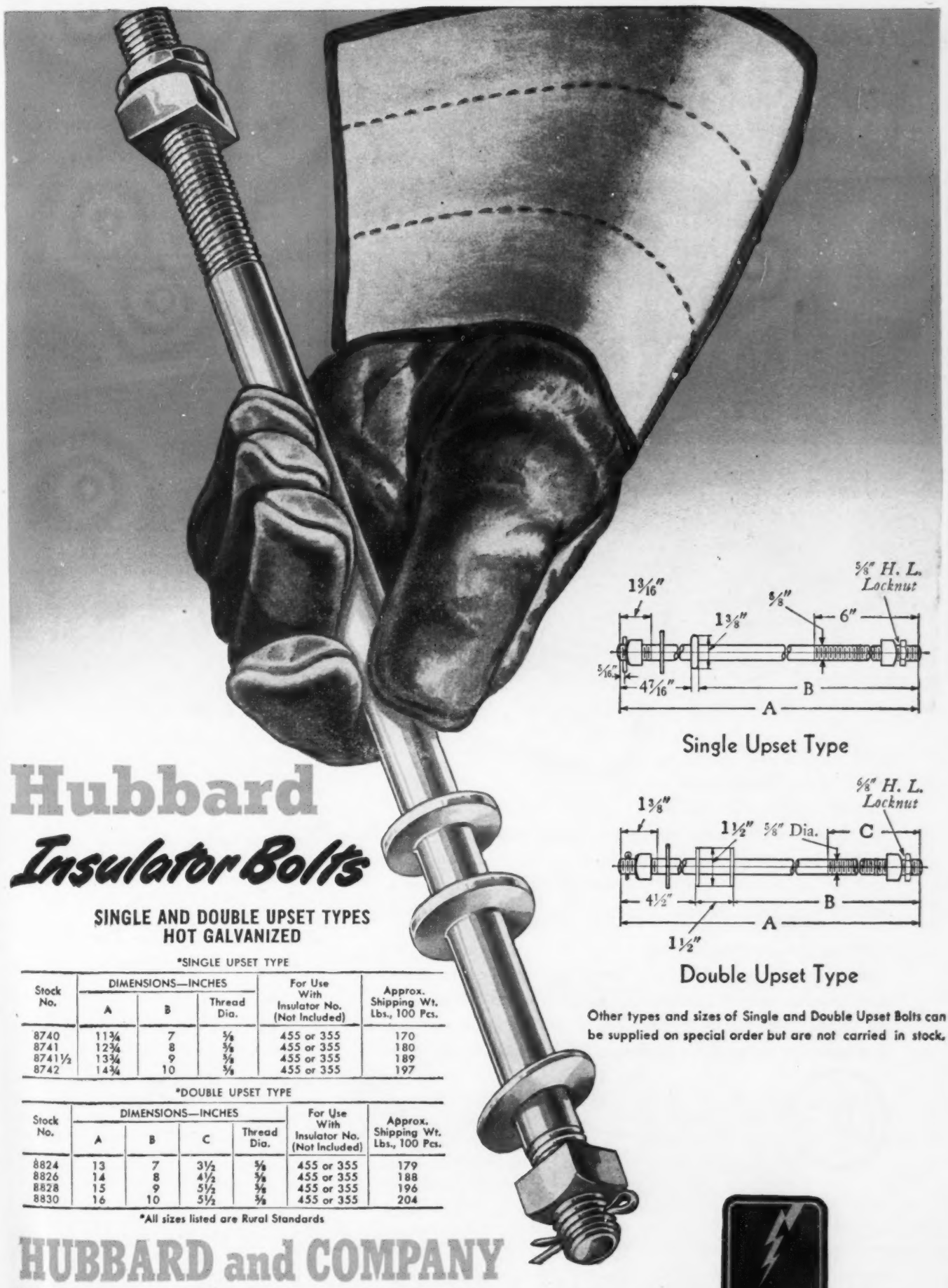
•

Capacitor with Feed-Through Characteristic Announced

A NEW hermetically sealed, metal-cased capacitor in which the current passes through the unit is announced by Cornell-Dubilier Electric Corp., South Plainfield, N. J. It is called the Feed-Thru Capacitor.

It is reported as suited to communications equipment for bypass, coupling, and filtering puposes and is stated to have low inductance, impedance, and resistance. Units are reported to have a low power factor and to be usable in temperatures up to 85 deg. C.

The hermetically sealed, metal, cylindrical containers are equipped with universal side



Hubbard

Insulator Bolts

SINGLE AND DOUBLE UPSET TYPES
HOT GALVANIZED

*SINGLE UPSET TYPE

Stock No.	DIMENSIONS—INCHES A	B	Thread Dia.	For Use With Insulator No. (Not Included)	Approx. Shipping Wt. Lbs., 100 Pcs.
8740	11¾	7	⅝	455 or 355	170
8741	12¾	8	⅝	455 or 355	180
8741½	13¾	9	⅝	455 or 355	189
8742	14¾	10	⅝	455 or 355	197

*DOUBLE UPSET TYPE

Stock No.	DIMENSIONS—INCHES A	B	C	Thread Dia.	For Use With Insulator No. (Not Included)	Approx. Shipping Wt. Lbs., 100 Pcs.
8824	13	7	3½	⅝	455 or 355	179
8826	14	8	4½	⅝	455 or 355	188
8828	15	9	5½	⅝	455 or 355	196
8830	16	10	5½	⅝	455 or 355	204

*All sizes listed are Rural Standards

Single Upset Type

Double Upset Type

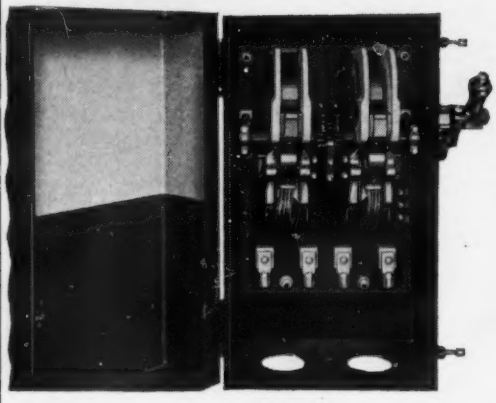
Other types and sizes of Single and Double Upset Bolts can be supplied on special order but are not carried in stock.

HUBBARD and COMPANY

PITTSBURGH • CHICAGO • OAKLAND, CAL.

Now--two more sizes of this

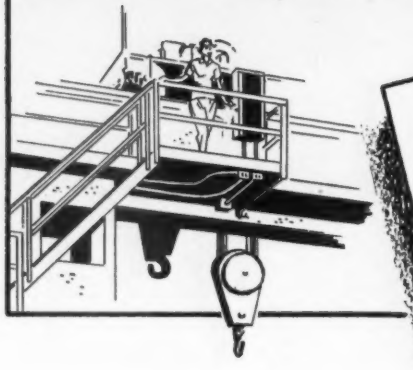
new **Safety Disconnect Switch for D-c Cranes**



1 Manual-magnetic type for ease of operation.

2 LINE-ARC design for high arc-rupturing ability.

3 Designed with parts associated with crane control to reduce the replacement-part problem.



Safety rules in many industrial plants and laws in several states require a safety disconnect switch on overhead traveling cranes, mounted at the point where the operator enters or leaves the crane. These switches disconnect the crane from the main collector power-feeders running along the crane runway.

Previously, operators, especially women, have had difficulty in opening and closing disconnect switches of the manually operated type.

This new EC&M *Magnetic Type* Disconnect Switch meets all the requirements of ease of operation, safety, convenience and reliability. It is of double pole design, completely enclosed and has side-type, externally-operated handle with thumb-latch which holds handle in either open or closed position.

Pushing the handle up closes the switch, pulling it down opens it—a cam roller forces contacts open, if necessary, and also insures against accidental closure due to vibration or an impact blow from another crane on the same runway. It allows for up to three padlocks for locking switch open.

E&M

New publication 1024, just issued, gives complete data on ratings, sizes, dimensions, etc. Copy will be mailed promptly upon receipt of your request.

THE ELECTRIC CONTROLLER & MFG. CO.

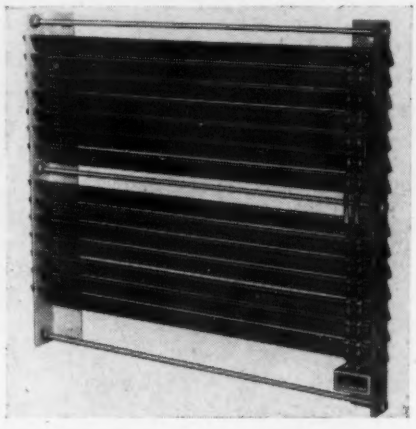
2698 EAST 79TH STREET - - - CLEVELAND 4, OHIO

mounting brackets with foil ends fully swedged by a new process. The d.c. rated voltages are 600 volts, the a.c. rated voltages, 300; both at 15 amp. Capacities range from 0.01 to 0.5 mfd.

•

Heater Has High Capacity In Small Space

A NEW Chromalox oven heater has been designed to provide high heating capacity in a small space (8 kw. in 33½x28x3-in. heater).



It was recently announced by Edwin L. Wiegand Co., 7513 Thomas Blvd., Pittsburgh 8, Pa.

The assembly consists of 14 chrome steel sheathed strip heaters. End brackets are made of sheet metal which are punched to permit mounting on either walls or bottom of the oven. Heater elements are mounted in the end bracket at a slight angle to the mounting surface to encourage air circulation.

On oven applications where forced air circulation is employed, the assemblies may be used as air duct heaters with a slight change in the position of the strips.

Heating element terminals are centralized at one end of the assembly and all connections are brought out to a single terminal box for connection to the 230-volt circuit.

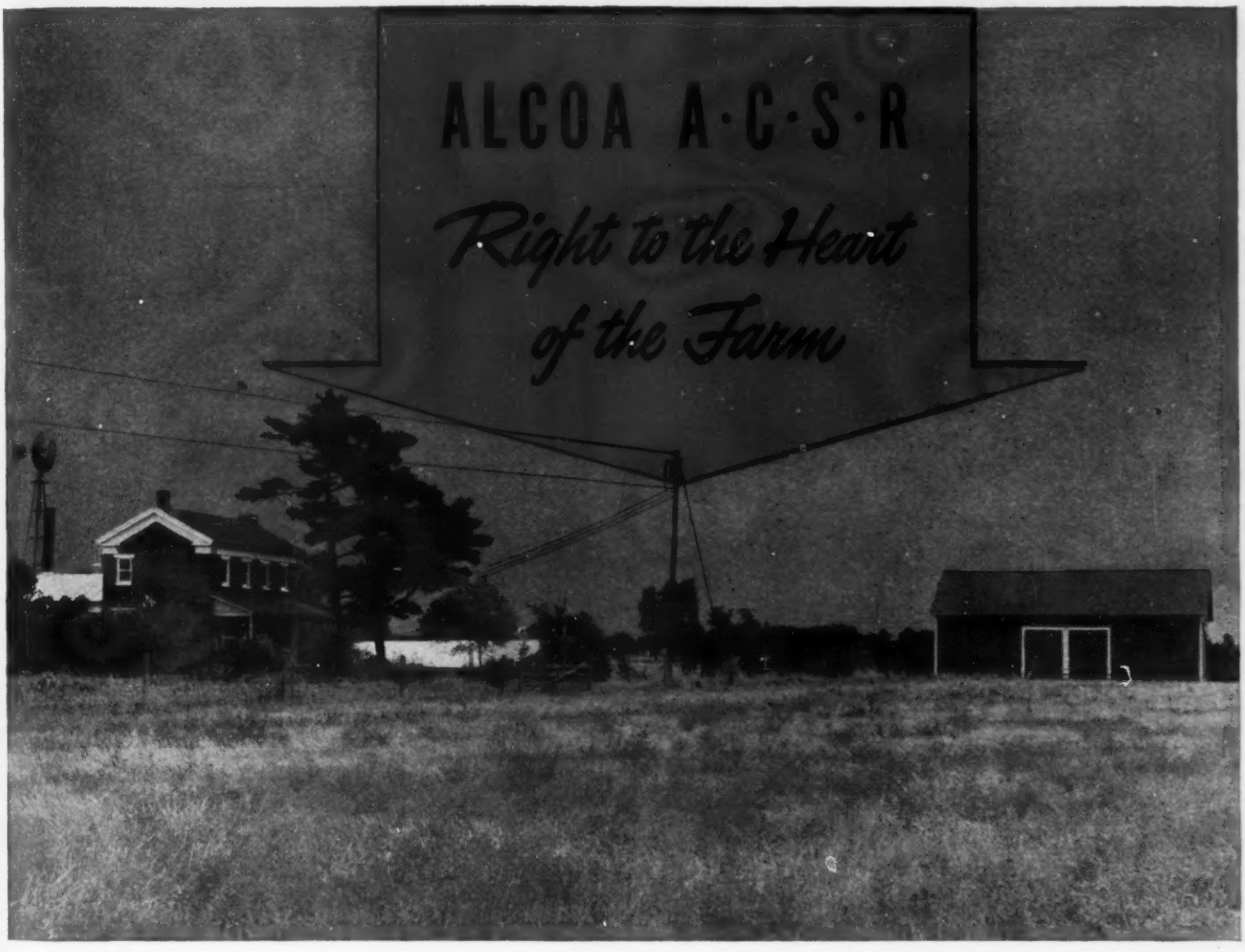
•

Glass Fiber Mats Produced By Johns-Manville

GLASS fiber retainer mats—thin diaphragms or filter screens for enclosing the positive plates of acid type storage batteries—are now being produced by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

These glass retainers hold any migrant granular particles of lead in the facial interstices of the glass fibers, from which they may be restored safely onto the positive plate surface when the battery is charged. Such minute lead oxide particles freed from the positive plate would otherwise drop into the sediment chambers. These retainers, nevertheless, are reported to permit practically unobstructed passage of electrolyte.

They are made up of thousands of long continuous fiber filaments in every one of the many layers which combine to make the mat. This built-up film is lightly impregnated with an acid-resistant phenolic type resin and is oven-cured. The tests indicate



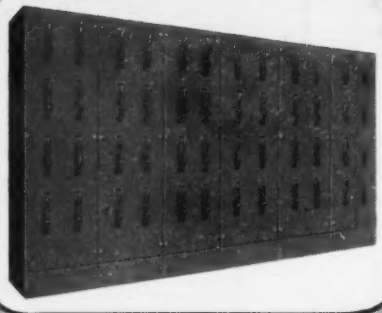
For every foot of line from the power plant to the pole in the farmer's yard, there's a suitable Alcoa conductor, Aluminum Cable Steel Reinforced — offering ample current carrying capacity to allow for future growth of load — having the high strength which permits long spans, lower cost construction.

Over a million miles of Alcoa A.C.S.R. —35 years' experience—have proved the dependability of these conductors. Alcoa engineering standards for line construction are based on the wealth of experience gained throughout these years.

For assistance in planning new lines or extending old ones, get in touch with the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA A-C-S-R
ALUMINUM CABLE STEEL REINFORCED

You're sure that it meets EVERY REQUIREMENT~



when~ your Switchboard is produced by

Pelham

We take full responsibility for meeting all specifications of architects and engineers . . . as well as municipal, state and federal requirements. You are completely relieved of all such detail work when your switchboard is designed and built by Pelham.

Exceptional Engineering Service. No matter how difficult your problems of design may be, our engineering department has probably met and solved them, in our wide experience.

Nothing but Highest Quality. All Pelham equipment is built with the best of materials and workmanship.

Dependable Service. Our deliveries are made when promised.

PELHAM ELECTRIC MFG. CORP.
Erie, Pa.

SPECIALIZED DESIGN
Pelham
UNEXCELLED QUALITY
SWITCHBOARDS · PANEL BOARDS
SWITCH GEAR AND ACCESSORIES

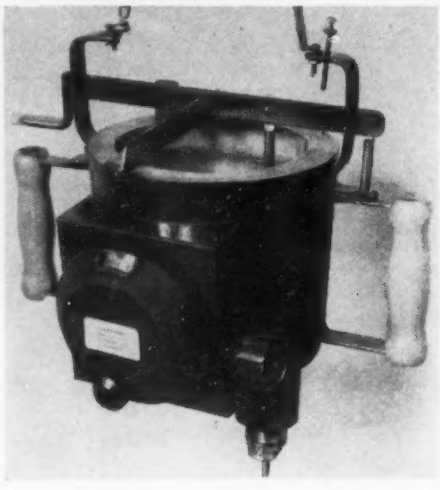
that glass fiber mats lengthen the life of a battery by as much as 50 percent.

Thicknesses of 10, 20, 30 and 40 mils are standard for storage battery use but special thicknesses are available from 5 mils to 100 mils for special industrial purposes. For this use mats are available in rolls 50 in. wide by 100 to 150 ft. long or intermediate sizes as may be required. Double mats are furnished with a center crease.

•

Suspended Dispensing Pot Aids Compound Handling

A MOVABLE, electrically heated dispensing pot for use with various compounds has been developed by Sta-Warm Electric Co.,



Ravenna, Ohio. It is designed for overhead suspension for ease in raising or lowering to proper elevation and has two side handles to guide the dispenser horizontally.

The needle is thumb operated, so that guiding and dispensing can be carried on simultaneously. Units are available for use on 110- and 220-volt, a.c. and d.c. circuits.

Among the features reported are cast aluminum body, heating units cemented uniformly over sides and bottom, variable thermostat control, needle valve separately heated, valve seats interchangeable, and adjustment screw that limits travel of operating lever.

It is reported as usable with such industrial compounds and materials as potting compounds, carbo-vitrobond (bushing material) sealing wax, pitch, asphalt, basolite, sulphur, resins, etc.

•

Kinetic and Dynamic Balance Obtained Electronically

AN ELECTRONIC wheel balancer, which determines where and to what degree automotive wheels are kinetically and dynamically unbalanced, has been announced by Stewart-Warner Corp., Chicago 1, Ill.

Vibration set up by the unbalance is picked up by a magnetic unit which transmits impulses to a meter. Dial readings indicate the degree of unbalance and actuate a stroboscopic light which indicates point of unbalance. The unit operates from a 110-volt, a.c. circuit.

Self-Propelled Rail Type Welder Made in Two Sizes

SELF-PROPELLED welders for railway service in 300- and 400-amp. sizes are being

announced by Hobart Bros. Co., Hobart Square, Troy, Ohio. Arc welder as well as vehicle is driven by a gasoline motor. Speeds up to 20 mph. are available and power is sufficient to tow a work car with ten men aboard.

The wheels of the unit are insulated and are of standard gage. It also has a special screw jack to shift the car to transfer rails.

•

Print Drying Surfaces Made of Aluminum

TWO NEW print dryers with drying surfaces made of polished aluminum have been announced by Fedco Products Co., 37 Murray St., New York, N. Y.

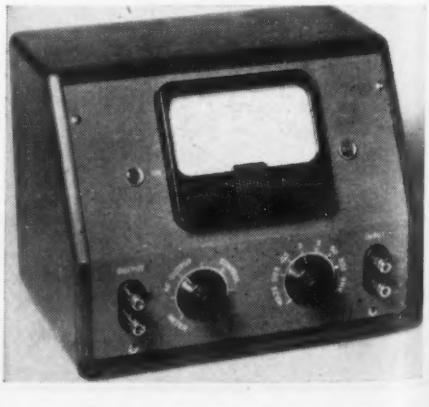
The twin print dryer has two drying surfaces, each measuring 11½ x 15 in., and accommodates eight 5- x 7-in. or two 11 x 14-in. prints at one time. It draws approximately 200 watts and may be used on either a.c. or d.c. circuits.

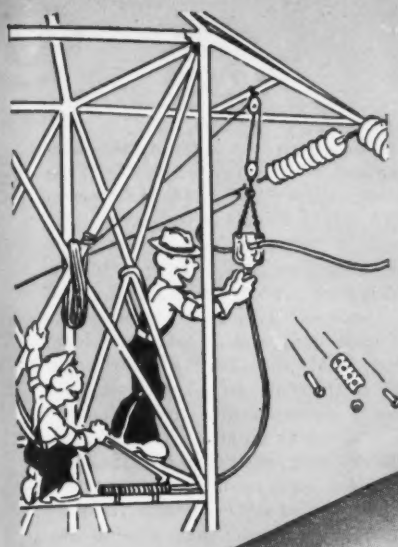
The single print dryer has one 11½- x 15-in. drying surface, draws 100 watts, and likewise may be used on either a.c. or d.c. Both models are reported to have a new type tension device which holds the prints in place.

•

Electronic Voltmeter Usable In 7-Cps. to 1.6-Mc. Range

AN ELECTRONIC voltmeter, Model 45, with a logarithmic scale and suitable for use in a voltage range from 0.0005 to 500 at frequencies from 7 cps. to 1.6 Mc. has been announced by Instrument Electronics, 253-21 Northern Blvd., Little Neck, L. I., N. Y. It is slated to be suitable for all voltage





new

before
ssure

Splice after compression. Hexagonal exterior of the splice is barely larger than the OD of the cable itself.

T&B ENGINEERED

METHOD OF *Compression* SPLICING

FOR A.C.S.R. JUMPER LOOPS

THIS new engineered development for ACSR jumper loop splices was designed in The Thomas & Betts Laboratories to facilitate more efficient performance of splices on high tension lines.

The T&B Compression Splice is a streamlined, one piece, unit operation job. Powerful hexagonal pressures are applied by a light-weight T&B Portable Hydraulic Tool with a capacity of 20 tons pressure. The Splice and cable are literally cold forged into one homogeneous mass of metal. The result is a vibration-proof joint with low resistance, the splice running cooler than the conductor itself. It provides easier and safer work for high tension crews.

Transmission engineers are urged to see the new T&B Compression Splices for ACSR Jumper Loops demonstrated on their own systems. Write us for an appointment that will be convenient to you. In the meantime, send for technical data in illustrated Bulletin W-1.

THE THOMAS & BETTS CO.

T&B

INCORPORATED

ELIZABETH 1, N. J.

All T&B products are sold exclusively through the service organizations of T&B Electrical Supply Wholesalers.

ER MANUFACTURERS OF WELL KNOWN T&B ENGINEERED FITTINGS INCLUDING THE *FIRST* LOCKNUTS AND BUSHINGS, ERICKSON COUPLINGS, CHASE NIPPLES AND

measurements in the vibration, audio, supersonic and broadcast frequency bands.

The complete range is covered by six switch positions, with all controls located on the front panel. Line voltage variations from 105 to 125 volts will vary the readings at all frequencies within the specified range by less than 1 percent, the report concludes.

•

Pentode Amplifier Tube Usable at 45 Volts

A NEW semi-remote cut-off pentode amplifier, designed for operation in portable battery and a.c. or d.c. receivers where plate supply may drop as low as 45 volts, has been announced by Sylvania Electric Products Inc., 500 Fifth Ave., New York 18, N. Y. Remote cut-off characteristic of the new type 1LG5 tube is stated to make it better suited to a-v-c circuits than type 1LC5. Efficient operation with 45-volt plate supply makes it complementary to types 1LD5, 1LC6 and 1LB4 for receiver circuit applications.

The tube filament is rated at 1.6 volts maximum for battery operation and has a design center of 1.3 volts for a.c. or d.c. operation. Maximum direct interelectrode capacitances, when $1\frac{5}{16}$-in. diameter RMA standard M8-308 shield is connected to the negative side of the filament, are: grid to plate, 0.007 max. micromicrofarad; input, 3.2 micromicrofarads; and output, 7.0 micromicrofarads.

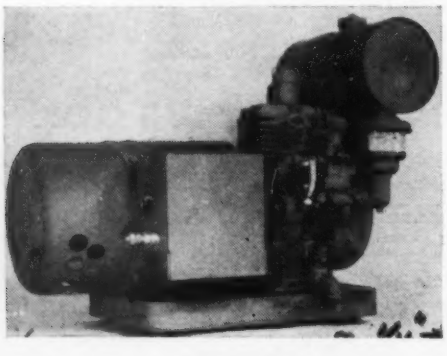
•

Generator Construction Simplifies Maintenance

A 500-WATT, 60-cycle, 1,800-rpm., self-excited generator for emergency use has been announced by Kato Engineering Co., Mankato, Minn. The generator is bolted directly to the side of the engine crankcase through a coupling which is stated to simplify generator maintenance.

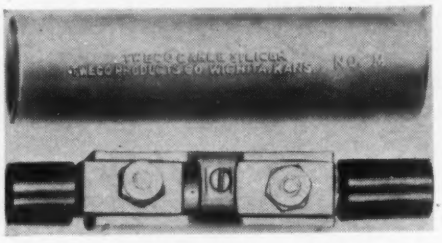
The unit, Model 23HAB4, comes equipped with pushbutton, cutout, d.c. ammeter, control resistor and battery cable. All plants have hand starting facility.

Generator is driven by a 1-hp. Briggs & Stratton aircooled engine which has a 2-in. bore and a 2-in. stroke. Flyball governor is stated to keep the frequency within practical limits.



Welding Cable Splicer Has Insulating Sleeve

A COMPLETE new line of Welding Cable Splicers was announced recently by Tweco Products Co., Wichita 1, Kan. It provides



a means of repairing broken cables or salvaged short lengths.

A simple clamp cable connection on each end of the splicer, with provisions for soldering between the cable ends, is said to insure a low resistance electrical connection. A fibre sleeve is provided to cover this connection.

It is made in three sizes to cover the full range of welding cables. Size "S" is designed for small cables, sizes, No. 4, 2 and 1; size "M", for medium cables, No. 1/0 and 2/0; and size "L", for large cables, No. 3/0 and 4/0.

•

Drafting Instrument Saves Electrical Designers Time

THE Electro Symbol, a new time-saving drafting board instrument of interest to designers and draftsmen in the electrical fields, is announced by RapiDesign, Inc., of Glendale, Calif. Working on the stencil principle, this device is stated to enable the engineer, designer, draftsman, student or amateur to fill in more quickly the more commonly used standard electric symbols employed on electrical circuits and designs.

It is made from heavy-gage, transparent, drafting instrument quality plastic sheets, with inner contours beveled. Claimed for the instrument, besides the time-saving factor, is greater accuracy, neatness and uniformity in the final layout.

•

Vibrating Rod Oiler Used in Dusty Areas

A VIBRATING-ROD bottle oiler which is automatic feeding and refillable without removal, made with a Lucite reservoir, has been announced by Oil-Rite Corp., 3466 South 13th St., Milwaukee 7, Wis. It is designed for use in high dust and dirt areas and is available with reservoir capacities between $\frac{1}{4}$ and 32 oz.

•

Solution Conductivity Recorder Draws 4 Curves

A MEANS of continuously and permanently recording the electrolytic conductivity of solutions, condensates or water by the solubridge method is now provided by the Type RP recorder offered by Industrial Instruments, Inc., of 17 Pollock Ave., Jersey City 5, N. J.

The recorder incorporates an a.c. Wheatstone Bridge circuit operating on the null balance principle. The accuracy is consequently made independent of line-voltage fluctuations and vacuum-tube characteristics. The instrument can be furnished for 1, 2, 3, or 4 continuous-line records on the same 12-in. diameter circular chart, a separate amplifier and motor-driven slide wire being used for each recording pen so that no switching devices are necessary. All pens of a multiple-pen recorder may move at any time or simultaneously.

The slidewire unit mounts on the inside of the hinged panel immediately behind the front door. The amplifier is normally mounted on the rear of the recorder casing, and amplifies the Wheatstone Bridge output voltage and provides the electronic control of the slidewire-drive motor both as to direction of rotation and speed. The amplifier is a standard and interchangeable unit.

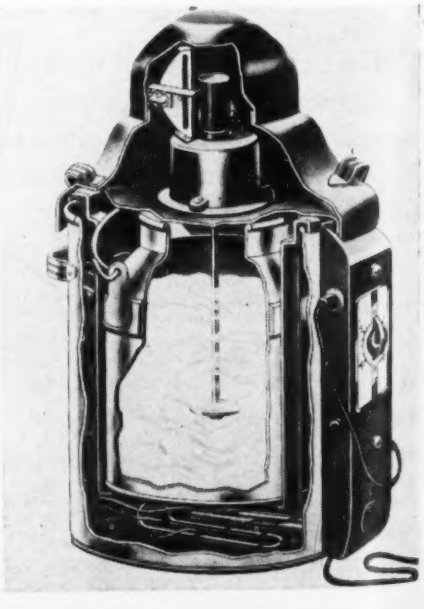
Housed in a metal cabinet, the instrument shows the circular recording chart through the glass window. As optional equipment, the recorder can also include a 29-in. indicating scale and bold indicator pointer, illuminated by an optional built-in fluorescent lamp, providing readability at 50-ft. distance.

•

Home Pasteurizing Unit Has 2-Gallon Capacity

"FAMILY-SIZE" milk pasteurizer with heating and agitation electrically provided has been announced by the Guard-It Mfg. Co., Chicago, Ill. It operates on a 110-volt, 60-cycle circuit and provides automatic timing and temperature control.

It is said to conform to U. S. Public Health Service requirements for proper pasteurization and was developed to combat milk-born diseases in rural areas.



CATALOGS and BULLETINS

A monthly digest of recent manufacturers' literature compiled by Electrical World for your convenience in securing without obligation the most recent information on electrical and allied products

CHECK ON COUPON BULLETINS DESIRED AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS

1 METAL BENDER: Circular 45 features a device used for bending busbars from $\frac{1}{8}$ in. to $\frac{3}{8}$ in. thick. Without changing the bending member, any angle up to 90 degrees may be formed. The whole machine is portable and can be carried around and clamped in an ordinary machinist's vise. Albert & J. M. Anderson Mfg. Co.

2 ARC-WELDING ELECTRODES: This bulletin contains 16 pages of information covering hard surfacing and the use of these particular electrodes in building up surfaces for resistance to shock and abrasion. Included also is a discussion on such factors as effect of temperature and cooling rate on deposited metal, selection of the proper grade of rod, and recommended welding techniques. Metal & Thermit Corp.

3 TRANSFORMERS: Bulletin 461 contains 12 pages of illustrated text on the use of power circuit transformers, drawn up as a reference aid to those interested in reducing wiring costs, upkeep and maintenance. Wiring diagrams and mounting suggestions are included along with a detailed table giving dimensions and data on double-wound and single-wound autotype transformers. A method for determining transformer capacity requirements is also suggested. Jefferson Electric Co.

4 BOILER METAL TREATMENT: Bulletin 410 features a scientific boiler metal treatment, used to loosen and remove scale from boiler metal and to prepare boiler metal surfaces to resist scale deposition and corrosion. It is also used to prevent rust, electrolysis and caustic embrittlement within the boiler. Morse Boulger Destructor Co.

5 AIR NAVIGATION LIGHTING: Technical data bulletin 314-F discusses many ways of lighting obstructions to air navigation, the purpose of which is to warn airmen during the hours of darkness of the presence of such a structure. Sketches of towers are given with straight line drawing of conduit, fixtures and condulet and wiring diagram for each job. Bill of material for radio tower is given for each size of tower. Crouse-Hinds Co.

6 SAFETY RELIEF VALVE: Publication 4150 describes and illustrates newly designed safety relief valve, used in numerous applications in relief of steam, air, gas, gasoline and oil vapors, water, etc. Of special interest are the revised sizing data on relief valves which include capacity and pressure rise tables unusually convenient to use for size selection. Cochrane Corp.

7 PYROMETER CONTROLLER: Bulletin D4-2 describes newest development in this manufacturer's series of electronic temperature controls. This multi-position electronic pyrometer controller uses two electronic control circuits with no mechanical contacts, which operate in harmony with each other, but independently. Control action is instantaneous. Applications and features of this new instrument are discussed. Typical installations and diagrams are shown. Wheelco Instruments Co.

8 FLOODLIGHTING POLES: Catalog 76 features a variety of poles designed for floodlighting applications. Contains 8 pages fully illustrated with photographs showing present installations and new applications of steel floodlighting poles. Included is information on construction, pole heights, assembly and erection, servicing features and engineering data. The Union Metal Mfg. Co.

9 HIGH-HEAT RESISTANT COATINGS: New bulletin announces a high-heat resistant coating that protects metal surfaces in power and process equipment against temperature damage from sub-zero to red-hot. Industries where this coating is now used include marine power equipment, railroads, petroleum refining, plastics molding, food processing, automotive and aircraft manufacturing, coke plants and public utilities. This bulletin lists the story of these coatings, tells what they do and how they are applied. The Dampney Co. of America.

10 MEASURING INSTRUMENT: Catalog 52-A describes a low flow rate measuring instrument. This instrument measures the drop-by-drop flow rates down to less than 5 milliliters per minute. When attached to Rotameters it can detect (by electronic means) the Rotameter float position. Flow rates encountered in laboratory or pilot plant operations as well as the small industrial flow rate such as of perfume essence, vitamin additives, inhibitors

Circle numbers, sign and mail. *Coupon good until September 15, 1946 only*

July 6, 1946

ELECTRICAL WORLD
330 West 42nd Street, New York 18, N. Y.

Please send me, without obligation, manufacturers' literature herein described and identified by numbers circled below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31

This coupon, properly filled in, is referred to the manufacturers for handling. Electrical World serves as a clearing house for this service.

NAME ..... TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....

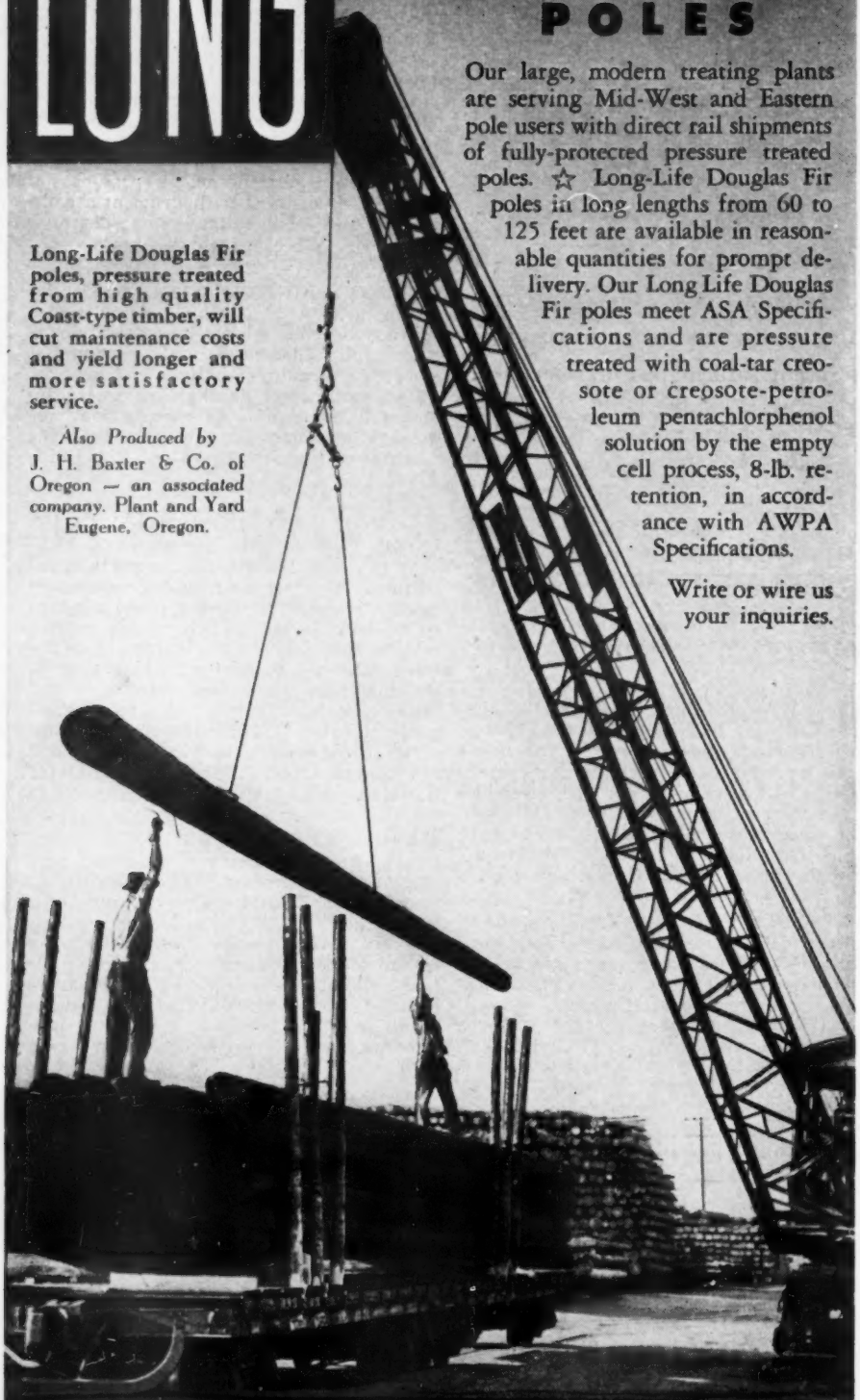
LONG-LIFE, DOUGLAS FIR, PRESSURE TREATED POLES

Our large, modern treating plants are serving Mid-West and Eastern pole users with direct rail shipments of fully-protected pressure treated poles. ☆ Long-Life Douglas Fir poles in long lengths from 60 to 125 feet are available in reasonable quantities for prompt delivery. Our Long Life Douglas Fir poles meet ASA Specifications and are pressure treated with coal-tar creosote or creosote-petroleum pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

Write or wire us your inquiries.

Long-Life Douglas Fir poles, pressure treated from high quality Coast-type timber, will cut maintenance costs and yield longer and more satisfactory service.

Also Produced by J. H. Baxter & Co. of Oregon — *an associated company.* Plant and Yard Eugene, Oregon.



J. H. Baxter & Co.

333 MONTGOMERY STREET • SAN FRANCISCO 4, CALIFORNIA
LOS ANGELES • LONG BEACH • ALAMEDA • CALIFORNIA, U. S. A.

and synthetic rubber mercaptan modifiers can be accurately and reliably recorded, controlled and totalized. Fischer & Porter Co.

11 DIESEL NOZZLE TESTER: Bulletin describes and illustrates a universal diesel nozzle tester, a product that tests all makes and models of diesel nozzles and injectors. These testers are available in a variety of sets—special, semi-universal, or universal. Illustrations are given to show methods of operating testers. Specifications are also given. The Budd Co.

12 PLASTICS: An 18-page booklet titled "Koroseal, The Modern Flexible Material for Industry" discusses a plastic (Koroseal) developed by the company's researchers. The booklet outlines the material's resistance to destructive elements, including corrosives, oils and solvents, flame, water, moisture, heat and aging, sunlight and oxidation. Mechanical properties, including adhesion to materials, flexing, machining qualities, abrasion resistance, coefficient of friction, hardness, impact strength, tensile strength, elongation, compressibility, compression set and dielectric strength are discussed. The B. F. Goodrich Co.

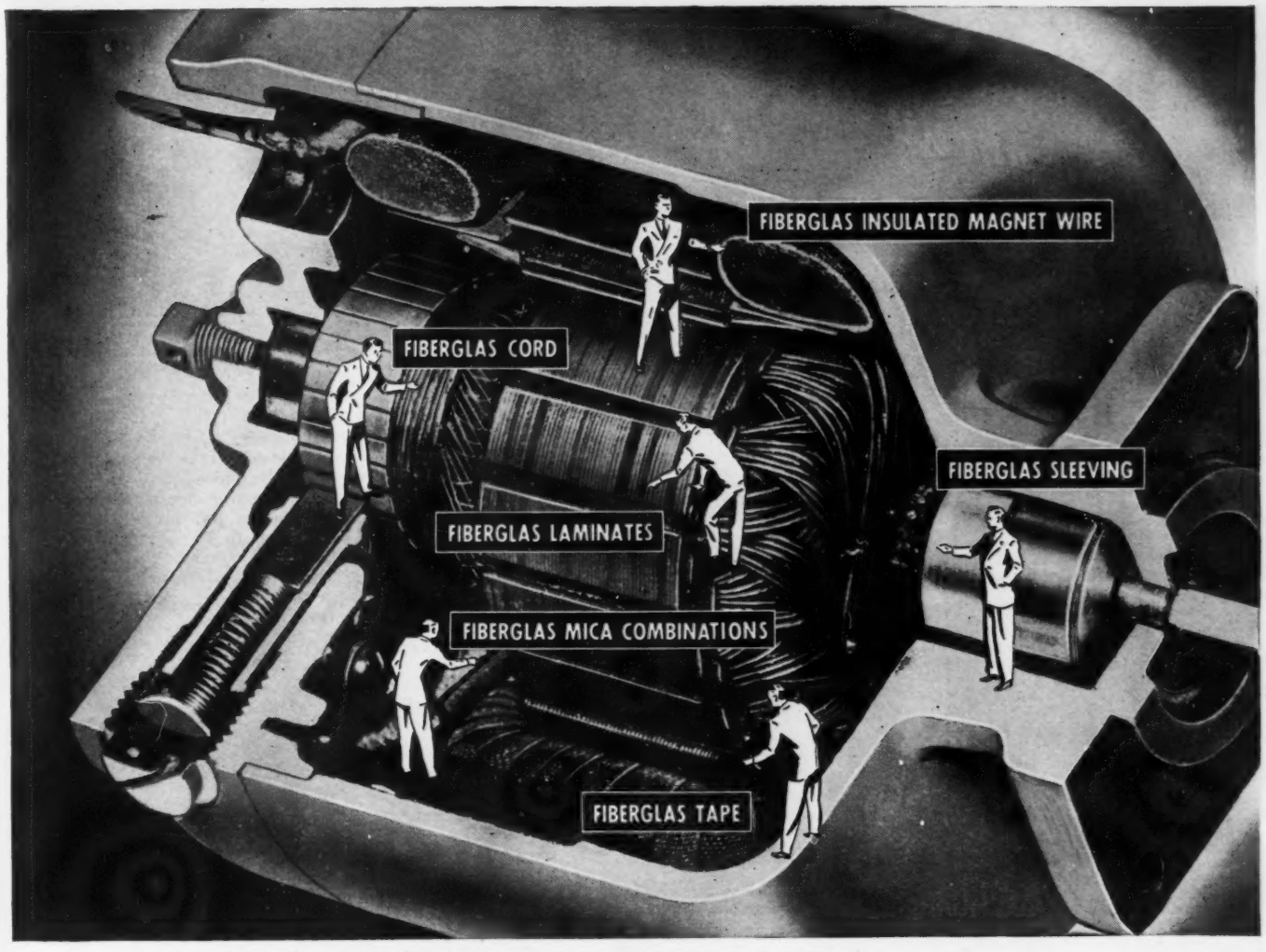
13 ELECTRONIC POTENTIOMETER-PYROMETER: A 16-page bulletin 232 describes and illustrates various indicating, recording and controlling combination of this new electronic potentiometer-pyrometer. This instrument has no continuously moving or vibrating parts in its measuring circuit. It records one or two temperatures on a 12-in. diameter uniformly graduated chart and indicates on a 29-in. bold scale which encircles the recording chart. General specifications with single line drawings are given. Bailey Meter Co.

14 TRANSFORMERS: Booklet contains 12 pages of written and illustrated text concerned with the fabrication of transformers. These transformers are used for a variety of applications—for cold cathode lighting, for neon signs, for fluorescent lamp ballasts, for use in radio and electronics and for power distribution. Illustrations are given. Acme Electric & Mfg. Co.

15 INSULATED WIRE AND CABLE: Data sheet No. 114 illustrates and describes a plastex insulated wire and cable. Complete description of the properties of Plastex is given. Contains also an engineering table which gives the physical and electrical properties of the material under varying conditions of temperature. Simplex Wire & Cable Co.

16 ELECTRIC FANS: A new catalog illustrating in color and describing in detail the complete line of this manufacturer's electric fans for the first post-war season is now being offered those interested in fans. This 28-page catalog illustrates and gives design and construction specifications with complete performance data on the various types of desk fans, air circulators, ceiling fans, kitchen ventilators, exhaust and cooler fans. Several new products, the 20-in. window-type cooler fan and two kitchen ventilating fans, are introduced. The Emerson Electric Mfg. Co.

17 THEATER LIGHTING: Brochure titled "Modernizing The Theater With Light" shows how to produce a great variety of wall and ceiling patterns by simply arranging the same standard fixtures in different combinations. Includes sketches illus-



Why "High-Safety-Factor" Insulation means greater motor STAMINA

In step with modern design and manufacturing practice is the increasing use of Fiberglas High-Safety-Factor Insulation Material. There is a Fiberglas Electrical Insulation Material for virtually every insulation need.

Fiberglas provides a thin, strong, flexible, *inorganic* base for insulating impregnants. This better insulation material has a unique combination of desirable mechanical and electrical characteristics found in no other single material. It helps provide greater protection against the *enemies of insulation*—excessive moisture, oil, heat, overload, most corrosive acids and vapors and human carelessness—the causes of most motor burnouts and failures.

Because Fiberglas Insulation helps give motors greater stamina, engineers and maintenance men, in every industry, are specifying and standardizing on Fiberglas Electrical Insulation—realizing that even one motor failure can cause time and dollar losses far greater than the slightly higher initial cost of equipment insulated with Fiberglas.

Fiberglas is the trade name for these electrical insulation materials and many other products made from fine, strong, pliable, moisture and heat-resistant, ageless glass fibers.*

Write for catalog EL 44-7, containing complete information about the unique combination of characteristics which make Fiberglas a better electrical insulation material. Owens-Corning Fiberglas Corporation, Department 858, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario

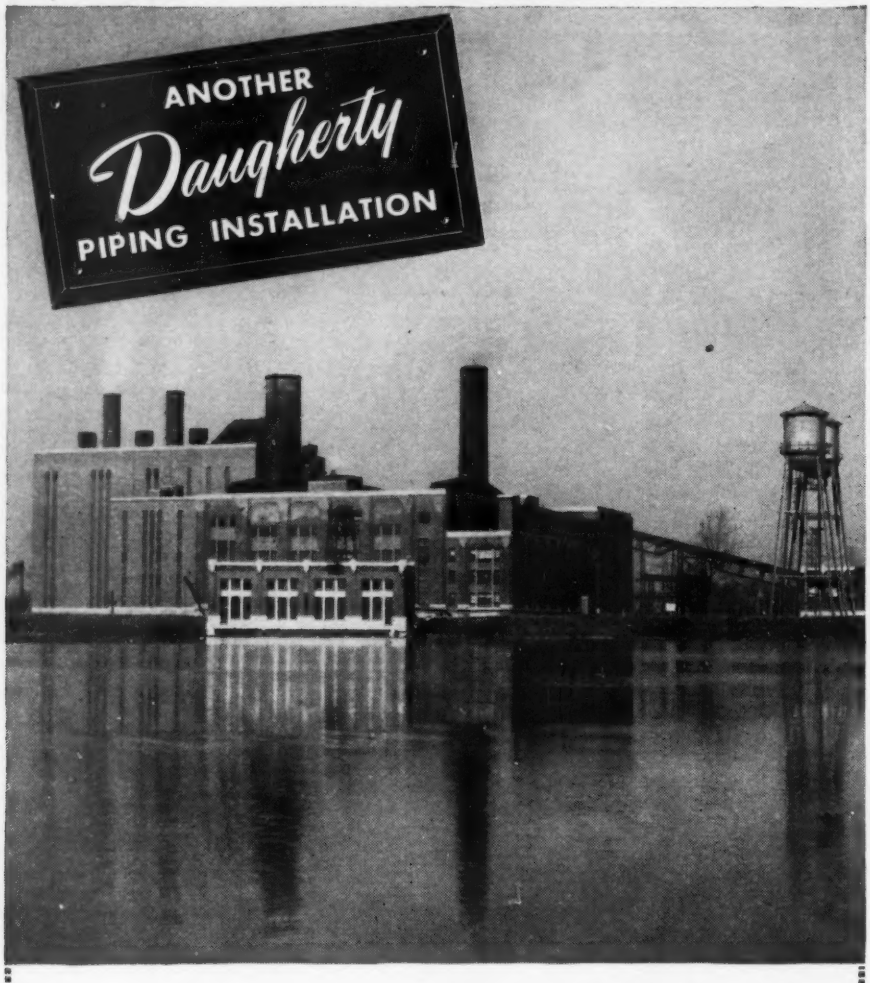
ASK FOR FIBERGLAS—IN YOUR NEXT MOTOR—AND ON YOUR NEXT REWIND

OWENS-CORNING

FIBERGLAS

T.M. REG. U.S. PAT. OFF.

***OTHER FIBERGLAS PRODUCTS: Thermal Insulations • "Dust-Stop" Air-Filters • Fiberglas Yarns and Cloths • Fiberglas Mats**



Indiana & Michigan Electric Co.
Twin Branch Station
Mishawaka, Ind.

The pipe fabrication and erection experience of the Daugherty Company is convincingly demonstrated by the successful handling of this outstanding installation having a normal operating pressure of 2350 lbs., at 940 degrees F.

To those responsible for power and process piping Daugherty Company offers these facilities: FABRICATION of high pressure, high temperature piping including alloy tubing. EQUIPMENT for field stress-relieving and radiographic inspection. WELDERS qualified for all classes of work. SUPERVISION by unexcelled metallurgical, engineering and construction staff.

Daugherty Company, Inc.

502 Union National Bank Building, Youngstown 3, Ohio

PIPING CONTRACTORS for the POWER and PROCESS INDUSTRIES

trating built-in architectural elements which employ fluorescent lamps and other lamps especially helpful for theater use. Also includes helpful hints on lighted signs, application ideas for germicidal lamps, and decorative, "theatrical" effects that can be produced by "black light" sources. General Electric Co.

18 TWEEZER SPOT WELDER: Folder features new tweezer spot welding machine. Unit is portable and weighs only 25 lb. With the use of the tweezers, the electrodes may be applied directly to the elements to be joined. The tweezers probe for the parts, hold and bend them and weld. Illustrations and directions on how to operate unit are given. Tweezer-Weld Corp.

19 AUTOMATIC OIL CIRCUIT RECLOSERS: Booklet features a new three-phase automatic oil circuit recloser for the protection of three-phase rural distribution systems. This equipment is designed to prevent overloading and burnout of three-phase motors due to line outages on any phase. Illustrations, including plan and cutaway views, are given. Recloser time-current curves are also shown. Kyle Corp.

20 HARDWARE: Another in the series of instructive little booklets on the subject of the Rivnut is presented here for distribution. The booklet treats, in entertaining fashion, many of the jobs the Rivnut has been called on to perform since it went into general usage after the war ended. The B. F. Goodrich Co.

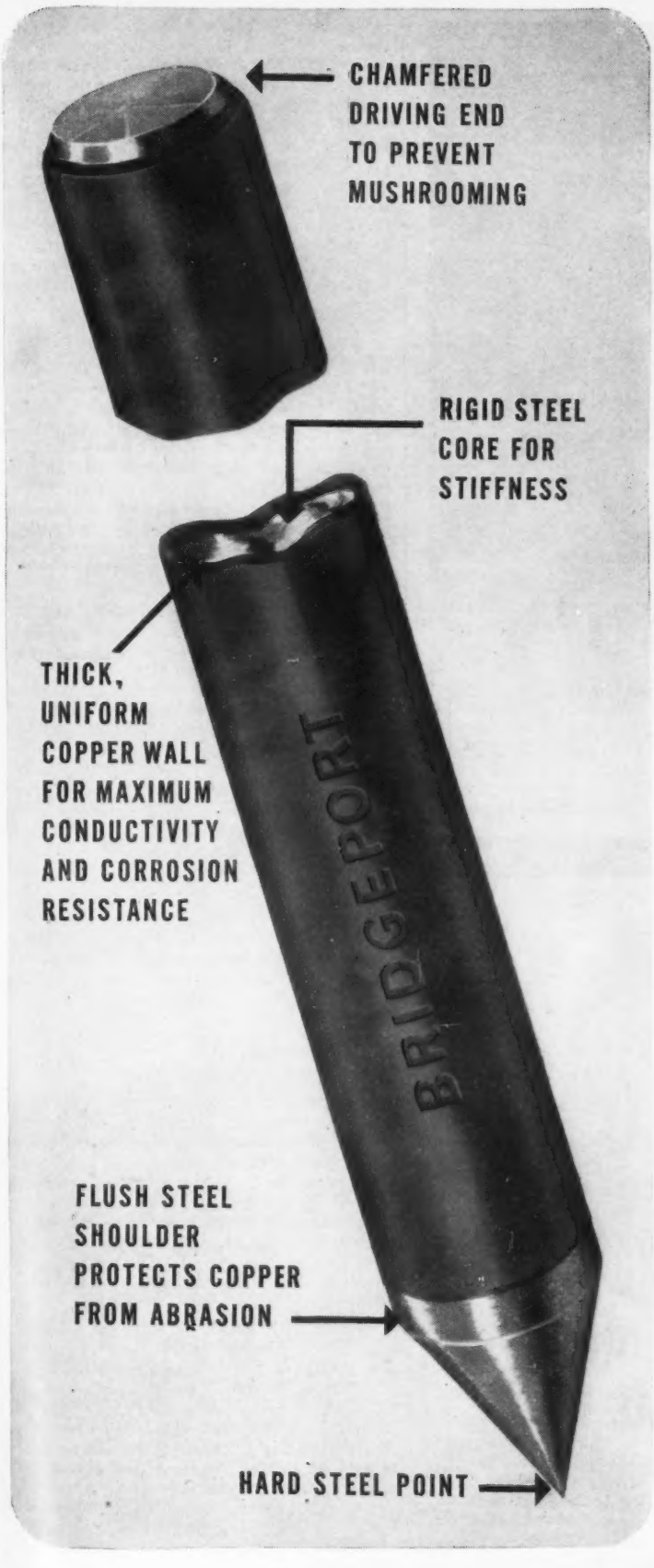
21 MOTOR-GENERATORS: Bulletin 202 features a variety of motor generators designed specially for electrolytic processes. This equipment is used in industry for sulphuric-acid anodizing, electrocoloring, electroplating, electrotyping, electrocleaning, electropolishing, chromic-acid anodizing and electrogalvanizing. Illustrations of various components are shown. Engineering data are given also. The Electric Products Co.

22 SILICONE RUBBER: This folder is number one of a series. Gives a general introduction to the new and improved silastic (silicone rubber), useful over a temperature range of —70 deg. F. to 500 deg. F. Silastic can be molded or extruded into any required shape. It can be supplied as a coating for glass cloth, metal or wire, and is useful as an electrical insulating material. Folder contains such technical data as heat stability, compression, electrical properties, chemical resistance, etc. Dow Corning Corp.

23 WATER COOLERS: Booklet contains full information about the complete post-war line of a.c. and d.c. water coolers for business, industrial, and institutional use. All models are illustrated, and complete specifications of each are given. Sunroe Refrigeration Co.

24 AUTOMATIC CLUTCH: Bulletin No. 45 describes and illustrates a special type automatic clutch used in a variety of applications. It is available in sizes from fractional horsepower to 5,000 hp. for any type of power drive. Three main elements make up this automatic clutch: a driving hub, the driven hub, and driving mechanism. Drawings illustrate typical applications of various types of drives. Hardinge Co., Inc.

25 MOTOR SERVICE PLANS: This new 12-page booklet describes in detail


CHAMFERED DRIVING END TO PREVENT MUSHROOMING
RIGID STEEL CORE FOR STIFFNESS
THICK, UNIFORM COPPER WALL FOR MAXIMUM CONDUCTIVITY AND CORROSION RESISTANCE
BRIDGEPORT
FLUSH STEEL SHOULDER PROTECTS COPPER FROM ABRASION
HARD STEEL POINT

Bridgeport Ground Rod

For Dependable Grounding Protection

Transmission and distribution lines, substations and other electrical installations require safe, dependable, positive, trouble-free grounding protection, which is readily obtainable with Bridgeport Ground Rods.

For long lasting protection from soil corrosion Bridgeport Ground Rods are made with a very heavy uniform copper wall, which is mechanically bonded to the rigid steel core. In addition, Bridgeport uses a patented flush driving point construction specially designed to protect the copper exterior from abrasion and damage when driven into hard, stony ground.

When driven into the soil, its streamlined shape makes a hole no larger than the rod itself, thus assuring an excellent copper-to-earth contact at all points. The driving end is chamfered to take the force of blows without mushrooming. Both ends are also tinned for improved conductivity.

Look for the Bridgeport name stamped on each ground rod for your protection.

General Distributors of Ground Rod: LINE MATERIAL COMPANY, Milwaukee, Wisconsin

COPPER BUS TUBING • DURONZE ALLOYS • CONDENSER TUBING

"Bridgeport" BRASS CO.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

. . . means better lighting at lower cost!

Fluor-O-Shields afford keener visibility — minimize stroboscopic effect, diffuse evenly and soften the light of fluorescent lamps. Fluor-O-Shields fit nearly all open-face fluorescent fixtures — 20W and 40W, single and multiple lamp units. Snap-on clips permit instant mounting. Made of lightweight aluminum, finished in white baked enamel. If your distributor does not stock, ask him to write us.

$1.95 40 watt 46⅞ in. $1.25 20 watt 22⅞ in.

SPECIFICATIONS

Cat. No.	Length	Fits Lamp	Units Per Pkg.
27-1-40	46⅞ in.	40 watt	12
27-5-40	22⅞ in.	20 watt	12

*Trade Mark — Patent Pending

FLUOR-O-SHIELD BY CAMFIELD MFG. COMPANY • GRAND HAVEN, MICH.

GOLD SEAL TAPE

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal specifications.

Watch the tough, long "teeth" form when you unwind it! A sure sign of stronger adhesive power . . . assurance of a tighter, longer-lasting, safer job. Gold Seal insulates with one thickness . . . stays tacky in cold weather, yet doesn't smear in hot weather. Doesn't peel or ravel. Sealed in cellophane, then boxed, to stay fresh. A good supply house near you stocks Gold Seal friction and Rubber Tape. Jenkins Bros., Rubber Division, 80 White St., New York 13.

JENKINS

Gold Seal Tape® FRICTION and RUBBER TAPES

MADE BY JENKINS BROS . . . MAKERS OF FAMOUS JENKINS VALVES

three service plans that provide service coverage for all fractional-horsepower motors. Tells who is entitled to use them, how they operate, and what can be accomplished when they are properly used. The motor exchange plan provides "over-the-counter" service for specified sizes and types of standard and special fractional motors. Special, semi-standard, non-current and competitive types of motors are serviced under the shop repair plan. And for manufacturers who wish to retain direct control of all field service activities, the national service plan sets up individual service policies. Westinghouse Electric Corp.

26 FEED-WATER CONTROL SYSTEM: Bulletin 447 describes and illustrates feed-water control system for world's largest forced-circulation boiler. Significant data are given to show the variety of equipment installed on this system. Single line sketch of entire system is shown, drawn to scale. Illustrations of parts of the system are also presented, together with a schematic diagram of the feed-water control system. Northern Equipment Co.

27 "INDUSTRIAL FREQUENCIES" CHART: This chart emphasizes the industrial frequency spectra from 60-cycle power through the germicidal and x-ray frequencies. It shows the frequency bands commonly used for inductive heating, dielectric heating, radiant heating, and infrared heating. Frequency is identified with equipments such as motor-generators, arc converters, spark gap generators and electronic high-frequency generators. Sherman Industrial Electronics Co.

28 FUSES: Bulletin 151 discusses construction of renewable fuses. Among other things it discusses reasons why the manufacturer developed "balanced log" refills, asks and answers the questions, what constitutes the fuse "overload range," why lag at overload ranges that are never reached in normal operation? Price list and specifications are furnished. Pierce Renewable Fuses, Inc.

29 TRANSFORMERS: Catalog 457 features a variety of distribution transformers from 1½-500 kva. Discusses principles of design, winding design used on all transformers made by this manufacturer, the kind of insulation used, how the cores and core frames are made, types of tap, terminal boards and tap changers, kinds of tanks, terminals and bushings. Illustrations and dimension reference sketches are shown, together with tables giving standards. Kuhlman Electric Co.

30 BELLOWS-DIFFERENTIAL FLOW METER: Bulletin F1603 describes in detail the features of the bellows type differential meter body, which requires no mercury. A cross-section drawing of the meter body clearly illustrates the method used to transmit bellows motion to the pen arm. The meter-body shaft is completely isolated from the measured fluid. Ranges available, both as recorders and controllers, are listed. The Bristol Co.

31 GENERATORS: Bulletin L-406 pictorially describes the standard line of portable gasoline-engine-driven generators developed by this manufacturer. Generator sizes range from 500 watt to 5,000 watt, a.c. or d.c., 6 to 230 volt, 50 to 800 cycle. The weight of the complete units vary from 48 lb. for the smallest size to 142 lb. for the 5,000-watt generator. Homelite Corp.

NEWS ABOUT PEOPLE

Kent Directs Engineering for EEI; Maxwell Retires

Harry E. Kent has been appointed director of engineering of the Edison Electric Institute, succeeding Alexander Maxwell, whose retirement took place at the end of June.

For a number of years, Mr. Kent served as principal assistant to Mr. Maxwell and his entire professional career has been devoted to engineering activities of the Institute and its predecessor organization.

Following graduation from the Massachusetts Institute of Technology in 1924,

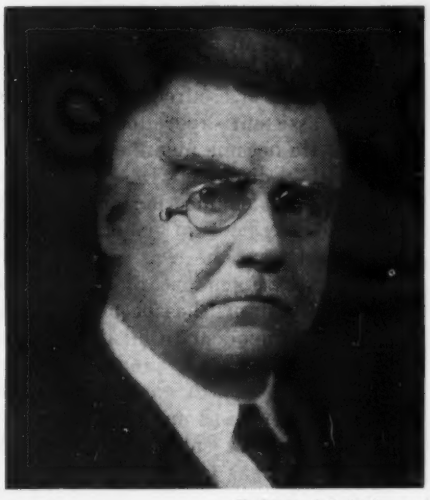
Blank & Stoller

H. E. Kent

he joined the National Electric Light Association in New York. For several years his principal responsibility was the organization and execution of joint development and research work with representatives of the Bell Telephone System on coordination of power and telephone systems. He was also active in coordination work with the Western Union Telegraph Co.

In addition to other duties as a staff engineer, he has served as secretary for the E.E.I. electrical equipment and industrial relations committees, and has supervised the staff work for the prime movers and transmission and distribution committees. He has been associated with a number of joint industry projects with other trade associations, and has also taken part in many standardization activities of the American Standards Association.

Mr. Maxwell's retirement followed



Underwood & Underwood

A. Maxwell

more than a half a century's association with the electric utility industry. After a brief connection with the Westinghouse Electric Corp. as laboratory and testing department engineer, he joined the Manhattan Electric Co. in 1895 as assistant to the electrical engineer. Except for a period of military service during World War I, he remained with that company and the New York Edison Co., its successor until 1923. His responsibilities with the New York utility included engineering tests of equipment, standardization of laboratory and measurements, original research in dielectrics, power cable and frequency control, and general field testing for all engineering, operating and sales departments. After the war, he played an important part in the re-design of the company's d.c. distribution system.

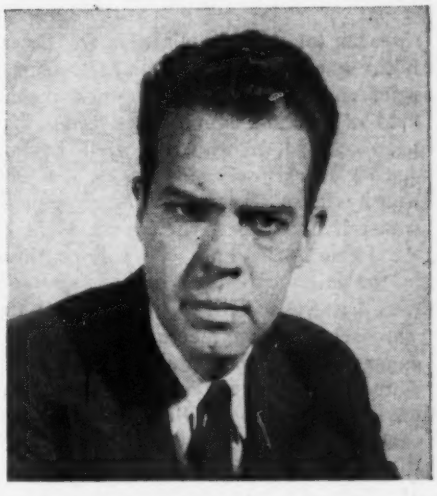
As an engineer on the staff of the National Electric Light Association from 1923 to its dissolution in 1933, Mr. Maxwell was engaged in research on the economics of power production and distribution. When E.E.I. was formed in 1933 he was appointed director of engineering of the new organization.

Mr. Maxwell has rendered distinguished service as an active member of the National Fire Protection Association charged with the formulation of the National Electrical Code and in industry relations with other bodies, such as the Bureau of Standards, American Standards Association, National Electrical Manufacturers Association and others. He is a fellow of the American Institute of Electrical Engineers and chairman of its board of examiners.

Braymer Named Managing Editor, "Electrical World"

Daniel T. Braymer, western editor of ELECTRICAL WORLD since 1939, has been advanced to the position of managing editor with headquarters in New York, effective July 1. In assuming his new duties as managing editor, Mr. Braymer is carrying on the tradition established by his father, the late Daniel H. Braymer, who some years ago was associated with ELECTRICAL WORLD, first as engineering editor and later as managing editor and co-editor.

Dan Braymer first became associated with the ELECTRICAL WORLD staff in 1935 as editorial assistant and after serving in



D. T. Braymer

that capacity for one year was made assistant editor. His promotion to the position of western editor followed in 1939.

Mr. Braymer obtained his engineering education at Cornell University from which he was graduated in 1933 with an M.E. degree. Before assuming his editorial duties on ELECTRICAL WORLD he was connected with the Howell Motors organization on motor assembly and test and with the operating department of the New York State Electric & Gas Co.

Mr. Braymer is a member of the Western Society of Engineers and has been serving as a director of the Electric Association of Chicago, 1945-46.

Frank E. Sanford, who joined the editorial staff of ELECTRICAL WORLD in the Chicago office last March, will be western editor to succeed Mr. Braymer.

Bell Telephone Labs. Names Bown Research Director

Dr. Ralph Bown, assistant director of research at Bell Telephone Laboratories since 1944, has been named director of

DR. R. BOWN

research for that organization. Dr. Bown, internationally recognized for pioneer research and development work in the field of communication engineering, has been associated with the Bell System since 1919. He succeeds Dr. M. J. Kelly, who has been serving both as director of research and executive vice-president of the Laboratories and who will continue in the latter capacity. In his new position, Dr. Bown will be in charge of the many scientists, engineers and technicians engaged in fundamental research associated with the Laboratories' technical responsibilities to the Bell System.

Dr. Bown served as president of the Institute of Radio Engineers in 1927, in which year the Institute also honored him with the award of its Morris Liebmann prize in recognition of his distinguished researches into wave transmission phenomena. He was a division member and consultant of the National Defense Research Committee, specializing in radar, and in 1941 he was sent to England by the U. S. Government to study radar operation under combat conditions. He has also served as expert consultant to the Secretary of War.

•

▶ PATRICK H. TUMELTY, manager of the Peabody (Mass.) municipal lighting department for the past 16 years, has retired after 44 years' association with the department. He was guest of honor at a recent dinner attended by 100 associates and friends, and was presented with a pair of high-powered binoculars on behalf of those present by C. F. Buckley, of Taunton, Mass.

▶ DR. FRANK B. JEWETT has received the Medal of Merit from Secretary of War Robert P. Patterson for "outstanding services as president of the National Academy of Sciences and as a member of the National Defense Research Committee."

▶ JOHN S. WAY has been appointed superintendent of substations, Commonwealth Edison Co., Chicago, to succeed Earle W. Grover, retired. Mr. Way was formerly assistant superintendent of substations. He became identified with Commonwealth Edison in 1909 and after holding various engineering positions was appointed engineer of maintenance in 1943. Last year he was promoted to assistant superintendent of substations. JOSEPH L. SCHUBER has been named assistant superintendent to fill the vacancy created by Mr. Way's promotion. Mr. Schuber started with the company 36 years ago. He was made assistant to superintendent of substations in 1945, which position has just been abolished.

▶ JOSEPH TERR has been appointed director of design of The Holdenline Co., Cleveland, and GERALD WISE has been named assistant sales manager.

▶ HUGH MCKEAN has been appointed superintendent of substation construction and maintenance over the entire system of the Florida Power Corp.—Georgia Power & Light Co. group. Mr. McKean was formerly connected with the Indiana Service Corp., Ft. Wayne.

▶ JOSEPH W. BARKER, dean of the Columbia University's School of Engineering, New York, has resigned to become president of the Research Corporation, New York, N. Y., a foundation for the support of investigations in educational and scientific laboratories throughout the United States. A fellow of the American Institute of Electrical Engineers, Dr. Barker is a member of the U. S. National Committee of the International Commission on Illumination and other technical societies.

▶ PROF. GORDON M. FAIR, a member of the university faculty since 1918, has been appointed dean of the Harvard Graduate School of Engineering, effective July 1, succeeding Dean H. M. Westergaard. Dean Fair is a widely known authority in the field of sanitary engineering, a member of the American Academy of Arts and Sciences, and other learned bodies.

▶ HAROLD S. ROBERTS has been appointed chief engineer of the generating plant of the Lawrence (Mass.) Gas & Electric Co., succeeding DEWEY ABELL, who retired recently after 60 years' service.

J. Thornborrow Joins Staff of Ebasco Services, Inc.

John Thornborrow, formerly with the Middle West Service Co. and Cleveland Electric Illuminating Co., has joined the rate department of Ebasco Services, Inc., New York, as rate consultant.

Mr. Thornborrow received his education at Illinois Wesleyan University and at the University of Illinois from which he received his B.S. degree in public utility operation and management, M.S. degree in public utility economics and Ph. D. degree in economics. During his college career he worked part time in the sales department of the Central Illinois Public Service Co.

J. Thornborrow

In 1935 he joined the statistical and rate department of that company and two years later was appointed rate engineer for the Southwestern Gas & Electric Co., the position he held until he became identified with the staff of the Middle West Service Co. in 1940. In 1945 Mr. Thornborrow was appointed supervisor of special studies for Cleveland Electric Illuminating Co., relinquishing these duties to join Ebasco Services.

•

▶ NATHANIEL TYLER has joined the Central Vermont Public Service Corp. at Rutland as an illuminating engineer. Before World War II he was connected with the Federal Light & Traction Co., and was lighting engineer for the Central Arkansas Public Service Corp., at Hot Springs.

▶ ALDUS S. TROWBRIDGE, district engineer for the New England Power Service Co. at Montpelier, Vt., has been appointed assistant distribution engineer with headquarters at Boston. FRANK R. GOODWIN, assistant district engineer at Fall River, Mass., has been named district engineer at Montpelier, and will

BEFORE AND AFTER — 4-H'ers William, Edward and John Halkovetz demonstrate their Better Method for grading eggs by electricity. Now two boys grade *six times* as many eggs as one did formerly when grading by hand.

"PRACTICAL TRAINING is important," says Warren Brockett, New Haven County Club Agent, as he explains to 4-H Club Members how to operate a jig-saw in the Guilford High School. Club Leader Arthur Cohen is standing at left.

The *Big Parade* to Better Methods is on . . . why not join it?

Do as scores of progressive utilities are now doing — by tying-in your rural activities with this national program that is *right now* operating in your territory.

There is nothing for you to *develop* or *originate* to identify your organization with the Better Methods Electric Contest.

FREE . . . EVERYTHING you need for promoting YOUR OWN Better Methods Electric Contest . . .

GUIDE BOOK — Explains Better Methods and how to apply them in simple, understandable language. Packed with factual information on farm and home jobs and chores.

REPORT FOLDER — Contains convenient blank forms for 4-H Club Members to develop and report their Better Methods Electric Projects.

LEAFLET — A complete explanation of each step of the Contest, also rules and regulations . . . for distribution to 4-H Club boys and girls.

POSTER — For display in your showroom windows in your farm territory — to establish them as information stations on the Electric Contest.

FARM BULLETINS — Twelve Bulletins on the many and varied uses of electricity on the farm and in the farm home.

IDEAS — Many useful suggestions to help you conduct your locally-sponsored Better Methods Electric Contest.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

It's not too late to get started . . .

With the best summer months ahead, start *your own* Better Methods Electric Program now by sending for the portfolio: "A Rural Community Service Program." In it you will find samples of the free material described above, and other helpful information. *Contact your nearest Westinghouse office — or mail coupon!*

Tune in: TED MALONE — Mon., Wed., Fri., 11:45 am, EDT, American Network.

MAIL COUPON TODAY!

Rural Electrification Section (EW-7646)
Public Relations Department
Westinghouse Electric Corporation
Box 1017, Pittsburgh 30, Pennsylvania

Please send *free copy of*
"A Rural Community Service Program."

Name.....

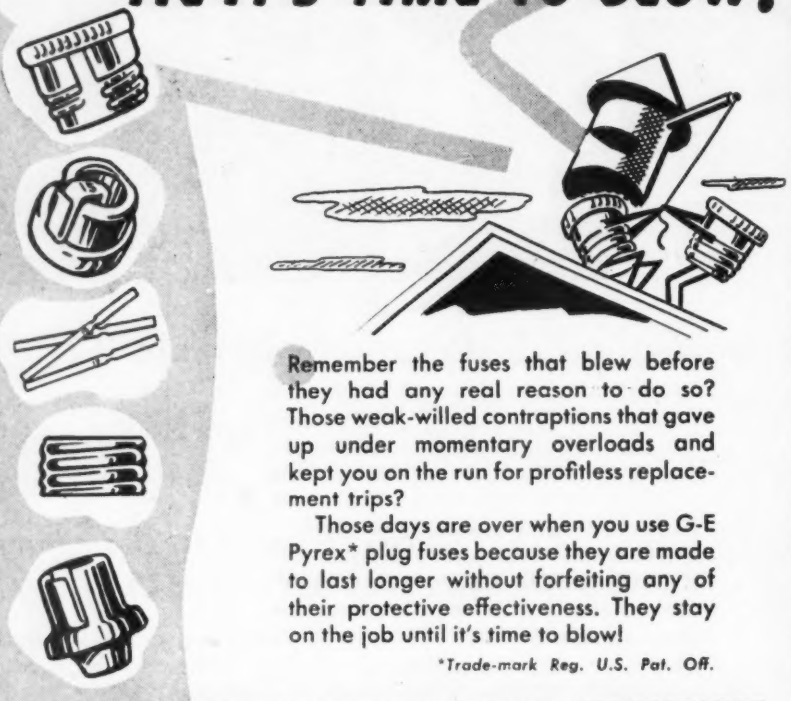
Position.....

Company.....

Address.....

City.....Zone.....State.....

THEY STAY ON THE JOB 'TIL IT'S TIME TO BLOW!



Remember the fuses that blew before they had any real reason to do so? Those weak-willed contraptions that gave up under momentary overloads and kept you on the run for profitless replacement trips?

Those days are over when you use G-E Pyrex* plug fuses because they are made to last longer without forfeiting any of their protective effectiveness. They stay on the job until it's time to blow!

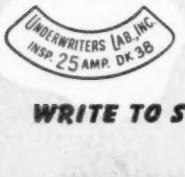
*Trade-mark Reg. U.S. Pat. Off.

G-E PYREX FUSES HAVE MANY OTHER ADVANTAGES THAT CONTRIBUTE TO GOOD SERVICE

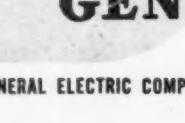
Ratings are easy to read

Double marking makes identification positive

Secure contact adds to safety



Handy dispenser cartons keep fuses readily available



Every fuse bears Underwriters' Laboratories label

WRITE TO SECTION D8-7-9 FOR DESCRIPTIVE LEAFLET

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, APPLIANCE AND MERCHANDISE DEPARTMENT, BRIDGEPORT, CONNECTICUT

have charge of the New Hampshire-Vermont area. LAWRENCE E. DOLAN, assistant engineer for the New England Power Service Co. at Providence, R. I., has been transferred to Fall River, Mass., as assistant engineer for the southeastern district.

▶ JOSEPH H. WADSWORTH has been appointed director of public relations of the Joshua Hendy Iron Works with headquarters at Sunnyvale, Calif. Mr. Wadsworth will have supervision of public relations and advertising for the company's three plants in Sunnyvale and Torrance, Calif., and Ampere, N. J. For the past five years, Mr. Wadsworth held a similar position at California Shipbuilding Corp. He succeeds JOSEPH F. DONOVAN, who has resigned after four years with Hendy to enter business in San Jose.

▶ HENRY A. STIX, treasurer of the Federal Machine & Welder Co., Warren, Ohio, and its subsidiaries, Warren City Manufacturing Co. and Sommer and Adams of Cleveland, has been elected executive vice-president of Federal operation. The action was taken at a meeting of the board of directors which also abolished the title "general manager" and assigned the responsibilities of general management to the executive vice-president. Mr. Stix is widely known in national financial and management counsel circles. He was for several years associated with the J. G. White Management Corp. and later was vice-president and comptroller of the Associated Gas & Electric Co.

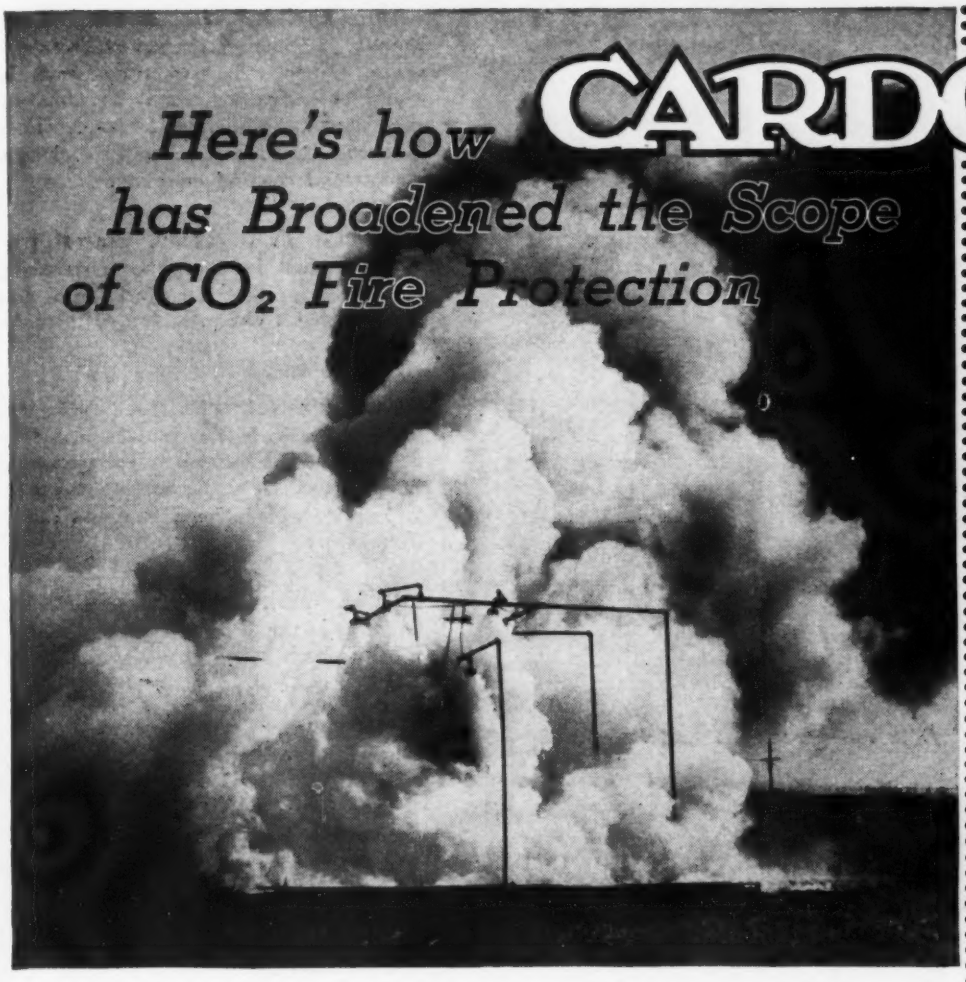
▶ ROBERT L. BARR has joined the staff of the Ralph T. Brengle Sales Co. of Chicago. Formerly sales manager of the Clough-Brengle Co., president of the Barr Manufacturing Co., and during the war a division engineer with Belmont Radio Corp., Mr. Barr has a wide experience of more than 15 years in the electronics field. He will have charge of design application and engineering development on a number of lines of technical equipment.

▶ GEORGE L. BEST, who has been assistant vice-president of the American Telephone & Telegraph Co., has been elected vice-president of the Western Electric Co. Mr. Best has been connected with the Bell System since 1922. In his new capacity, he will have charge of securing necessary licenses under patents of others for use by the Bell System, and for licensing others to use Bell System inventions.

▶ HARRY E. WARREN has been appointed New York manager, Ralph H. Jones Co., advertising agency, Cincinnati. Mr. Warren has been with Edison General Electric Appliance Co., Chicago, for the past eight years, holding positions as manager

CARDOX

Here's how has Broadened the Scope of CO_2 Fire Protection



Carbon dioxide has, of course, long been recognized as one of the fastest, most effective fire fighting agents. Its advantages as a non-damaging extinguishing medium, with no clean-up mess or time loss, give it an important plus value in many industries and situations.

The problem has been to make this dry, inert gas practically available in fire fighting equipment equally capable of protecting small, multiple or very large hazards.

Cardox Fire Fighting Equipment . . . using its own unique methods of engineered control and application . . . has multiplied the applications of carbon dioxide as a fire fighting medium.

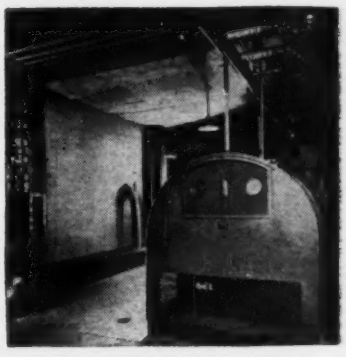
As a result of these distinctive Cardox developments, *low pressure* liquid carbon dioxide can be applied with equal facility in *pounds* or *tons* . . . making it entirely practical to use this fast, non-damaging medium (1) To protect banks of large transformers outdoors, (2) To provide tons of Cardox CO_2 on a high speed truck to guard widely scattered hazards, (3) To overwhelm vicious airplane crash fires fast anywhere on large airfields . . . making possible speedy rescue of plane personnel and salvage of costly equipment, (4) To provide a *single system* capable of protecting multiple hazards throughout large plants, (5) To equip factories, hangars, etc. with a *portable unit* with sufficient wallop to deal with relatively large fires *when seconds pay dividends.* All Cardox Fire Fighting Equipment has one characteristic:

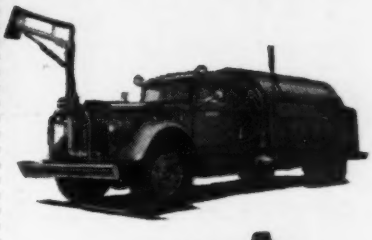
The distinctive Cardox method of control and engineered application of carbon dioxide, stored at 0°F. and 300 p.s.i. in a single storage unit containing from ¼ to 125 tons of fire-destroying Cardox CO_2 . . . enough to handle even large fires and leave an ample reserve for new emergencies.

As a result of the removal of former limitations to the use of carbon dioxide by Cardox control and application, Cardox Fire Extinguishing Equipment can be engineered to provide protection for hazards indoors or out. We should welcome the opportunity of helping you evaluate accurately the place of Cardox Broadened CO_2 protection in your specific operation. *Write for Bulletin No. 516.*

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices in
New York • Philadelphia • Washington • Pittsburgh
Cleveland • Detroit • Cincinnati • Houston
San Francisco • Los Angeles • San Diego

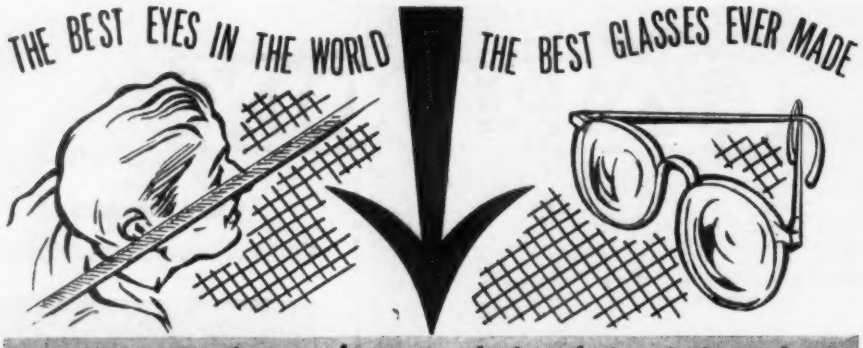
Typical Examples of Cardox Fire Fighting Equipment





(1) Cardox Fixed Systems. Provide 500 pounds to 125 tons of liquid carbon dioxide. **(2) Cardox Fire Trucks.** Tons of CO_2 on wheels for application through hose lines or standpipe systems. **(3) Cardox Airport Fire Truck.** Uses mass attack to overwhelm vicious crash fires fast. **(4) Cardox Transitank.** Portable unit with a capacity of 750 pounds of carbon dioxide. Now available in certain parts of the country in hand propelled, and motorized models.

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS



. . . are not good enough to detect tension and sag to TODAY'S standards!

Be CERTAIN with a Dillon DYNAMOMETER

Quickly gives you exact readings. Takes out all guessing. SAVES TIME. Saves maintenance. Up-to-the-minute telephone men are using Dillon Dynamometers for guys, conductor, strand or high tension wire. Large easily read figures in pounds, instantly read. No charts. No figuring. Compact, easily carried. Nine capacities for 500 to 20,000 lbs., all same size.

Weight, 8 lbs., 4 oz. Size 8¼" x 6¼" x 3". Not injured by overload. Strong construction cased for all weathers

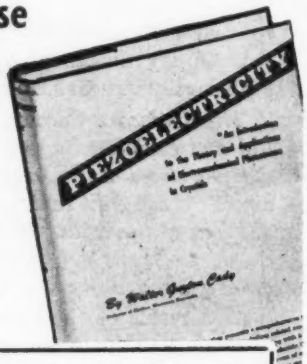
Wire, write or phone for illustrated folder with full details.

W. C. DILLON & CO. Inc.

3410 W. Harrison St., Chicago, Ill.

Improve your understanding and use of piezo-electric devices

with the aid of this thorough treatise on electromechanical phenomena in crystals



This new volume in the International Series in Pure and Applied Physics book brings you a most complete compilation of practical data on this important subject. It presents each phase of piezoelectricity in illuminating detail, covers all crystals with piezoelectric properties, elasticity, pryoelectricity, the piezo resonator, dielectrics, crystal optics and magnetism, Rochelle salts, Seignette-electrics, ferromagnetism. This foundation of data opens the way for sweeping advances in the field.

Just published!

PIEZOELECTRICITY

By WALTER GUYTON CADY

Professor of Physics, Wesleyan University

806 pages, 5¾ x 8¾, 36 tables, 168 figures, $9.00

Here are all the facts and data on piezoelectricity and its applications which facilitates its use. Highly practical information is presented: data for all crystals that have been investigated quantitively, a unified account of experimental results, with many formulas, numerical data, and large bibliography, many important diagrams, charts and reference tables. An exhaustive study of Rochelle salts and other Seignette-electrics, their use and future applications, is included.

direct, practical working aids:

- numerical data on properties of crystals
- diagrams illustrating these properties
- working formulas for use in calculations
- practical information on principles underlying measurements
- practical information on techniques of quartz and Rochelle salt
- how crystals work in various applications

Some of the important topics and new material covered in detail:

—proper choice of cuts and electrodes for exciting various piezoelectric effects
—experimental devices for the preparation and testing of plates for crystal resonators
—suggestions concerning demonstrators for piezoelectric effects
—x-ray reflections from vibrating crystals
—an adjustable model for illustrating elastic properties
—a new form of polariscope for the examination of quartz

See it 10 Days FREE • MAIL COUPON

McGraw-Hill Book Co., 330 W. 42 St., N.Y.C. 18

Send me Cady's Piezoelectricity for 10 days examination on approval. In 10 days I will send $9.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Company .....
Position .....W 7-6-46

(For Canadian price, write Embassy Book Co., 12 Richmond St. E., Toronto, 1).

of three national sales divisions, home laundry, kitchen equipment and refrigeration, and for the past three years in charge of advertising and coordinating merchandising activities for twelve lines of home appliances, as well as electric commercial cooking equipment.

▶ DOUGLAS F. G. ELIOT, general purchasing agent in charge of purchasing and traffic for Western Electric Co., has been elected a vice-president of the company.

▶ JOHN L. BROWN has been appointed sales manager of the replacement tube department, Raytheon Manufacturing Co., Newton, Mass. Before entering military service, Mr. Brown was with Zenith Radio Corp.

▶ R. M. WALKER has resigned as chief engineer of the Brooker Engineering Co., Detroit, Mich.

OBITUARY

▶ J. ALFRED CONE, managing-director of the Pembroke Electric Light Co., Ltd., Pembroke, Ont., Canada, died on June 18. Mr. Cone, who was in his 86th year, was born at Bristol, Que., and is reputed to have been the oldest active electrician in the Dominion of Canada. In 1887 he started working for the Pembroke Electric Light Co., becoming its manager in 1910. In 1934 he was appointed a director and continued to take an active interest in the business up to the time of his death.

▶ WALTER F. NORTON, retired manager of the Nashua district of the Public Service Co. of New Hampshire, died on June 5. Born in Boston, Mass., in 1873, Mr. Norton began his career in the public utility field in 1890 in the meter department of the old Nashua Light, Heat & Power Co.

▶ JOHN S. CRAVENS, first president of the Edison Electric Co. of Los Angeles, from 1899-1901, died on May 17. Mr. Cravens was associated with the Edison Electric Co. from late in the 1890's to 1907, when he resigned as a trustee, having resigned as president in 1901. Mr. Cravens was a director of the company from 1898 to 1899, when he became president, and following his resignation from that position he became a director, the position he held at the time of death.

▶ THOMAS J. STANLEY, since 1928 Eastern sales manager for the Taylor-Colquitt Co., Spartanburg, S. C., died on June 17 in New York after a brief illness. Mr. Stanley was born in Austin, Tex., 57 years ago.

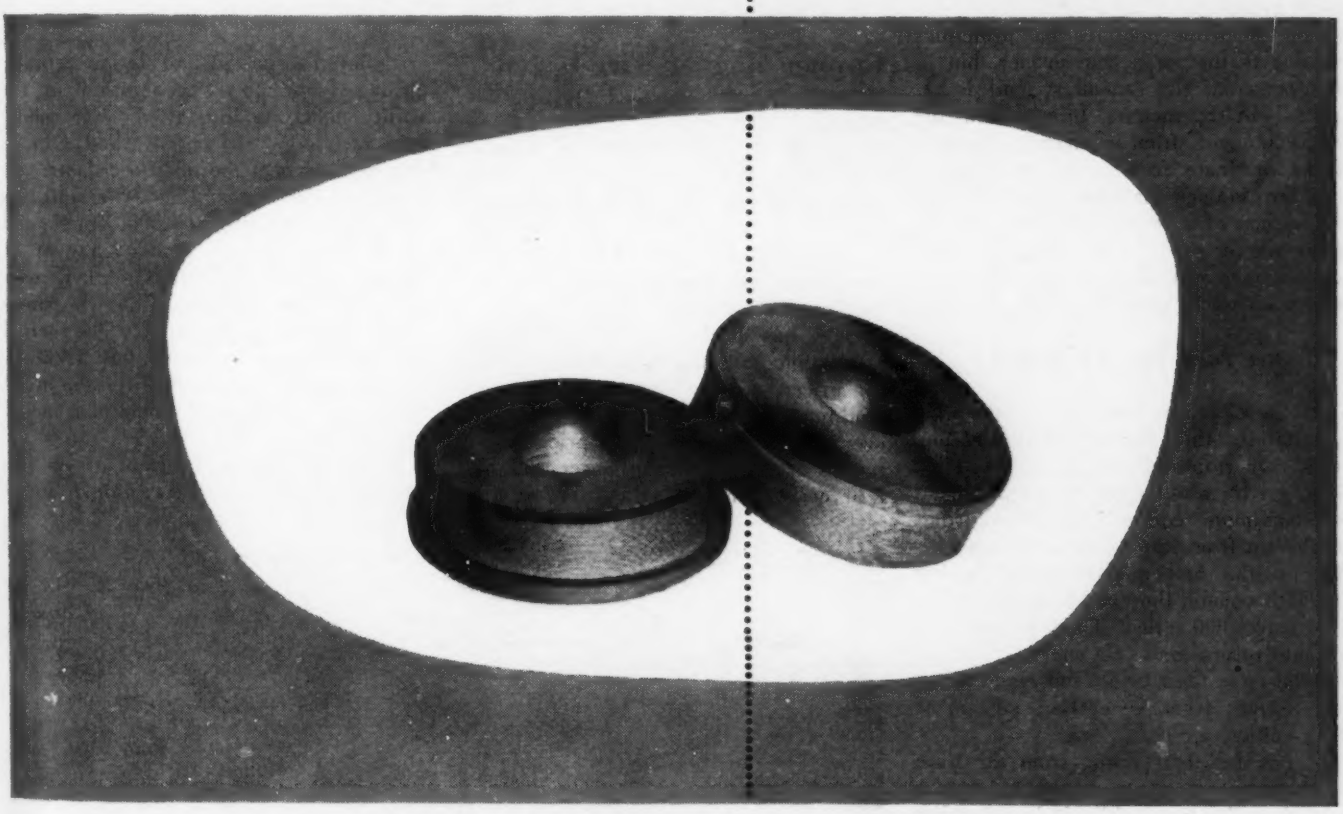
Case Histories from the **RICHARDSON** *files*

PRODUCT RE-DESIGN

Problem: *To re-design bearings on bottle vending machine. Must be non-corrosive to withstand moist atmosphere. Bore of finished part must serve as a non-lubricated bearing, while the outer periphery must resist abrasive action.*

Solution: Using Laminated INSUROK, Grade CG, Richardson Plasticians furnished precision plastic bearings having the required characteristics. For Grade CG INSUROK contains a high percentage of natural graphite, has excellent strength qualities, resists abrasion and the action of moisture.

The versatility of The Richardson Company is at your service no matter what the plastics application may be. Through the correct use of INSUROK, both *molded* and *laminated*, Richardson Plasticians have shared in the rapid growth of many industries. Tell us your plastics problems . . . and let us help you solve them!



INSUROK *Precision Plastics*

The RICHARDSON COMPANY

LOCKLAND, CINCINNATI 15, OHIO FOUNDED 1858 *Sales Headquarters:* MELROSE PARK, ILL.

Sales Offices: NEW YORK: 75 WEST STREET, NEW YORK 6, NEW YORK
CLEVELAND: 326-7 PLYMOUTH BLDG., CLEVELAND 15, OHIO
DETROIT: 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN

Factories: MELROSE PARK, ILLINOIS
NEW BRUNSWICK, NEW JERSEY
INDIANAPOLIS 1, INDIANA

MANUFACTURERS & MARKETS

G. E. Betatron Operating At 160,000,000 Volts Soon

Units' 100,000,000-Volt Output Raised to 160,000,000 Volts by Use of D.C. Bias Technique

By a relatively simple improvement, the 100,000,000-volt betatron in the General Electric Research Laboratory may soon have its output energy raised to 160,000,000 volts. This was announced recently by Dr. C. G. Suits, company vice-president and director of the research laboratory, who credited W. F. Westendorp, of the laboratory's x-ray section, with responsibility for the improvement.

The betatron operates on principles similar to that of a transformer, but in the betatron, the secondary coil is replaced by a vacuum tube called the "doughnutron" from its shape. The electrons originate from a heated filament and flow in open space instead of through the atoms of a wire. They are held in their proper orbit by the magnetic field of the huge electromagnet in which the doughnutron is placed.

Get Them Out at Top Speed

If the electrons remained in the tube continually, they would first revolve one way, then stop and reverse, but the trick is to get them out while they are moving at maximum energy. As the current builds up from zero to its maximum voltage in the first quarter cycle, lasting 1/240th second, they make 250,000 turns and travel 800 miles. Then, before they go into reverse and lose energy, they are shifted from their orbit, and made to hit a tungsten target, generating a beam of high-voltage x-rays.

For a full half cycle, from the time the current is at a maximum in the negative direction, while it is returning to zero, and then building up in a positive direction, the voltage is positive and in the proper sense to speed the electrons. This offers the possibility of accelerating them for nearly twice as long as with the present method and consequently increasing their energy. However, the difficulty is that while the voltage is passing from zero to its positive maximum, the magnetic field is in the wrong direction for guiding the electrons in their orbit.

The method Mr. Westendorp devised for overcoming this difficulty is called "d.c. bias." In addition to the alternating current, a direct current can be applied to the electromagnet. This shifts the zero line from the middle of the current wave to its bottom, and nearly the whole of the rise can be utilized.

"By the use of this principle, and some other improvements that may be used with it, it is possible to get substantially higher energies with the same weight of magnet," said Dr. Suits. "We are modifying our 100,000,000-volt machine for biased operation and expect to obtain 160,000,000 volts with relatively small changes in the core of the magnet."

•

Copper Magnet Wire Listed "Scarce"; Pump Prices Up

Among the items added to the Civilian Production Administration list of critically scarce products is copper magnet wire. Urgency certificates are issued only to producers of these products when such equipment will sustain or increase production, CPA stated.

OPA has authorized substantial temporary increases in manufacturers' ceiling prices of power-operated pumps and equipment, granting a rise of 15 percent over base period ceiling prices when pumps are sold with the power unit, and 8 percent when sold without the unit.

Borg-Warner Completing New Utility Household Unit

The Ingersoll Steel division of the Borg-Warner Corp. is putting final engineering touches on a new model of the Ingersoll utility household unit for low cost homes in the veterans' price bracket, the company has announced.

New design includes a complete kitchen and bathroom around a utility core containing the heating plant and other utilities formerly placed in basements.

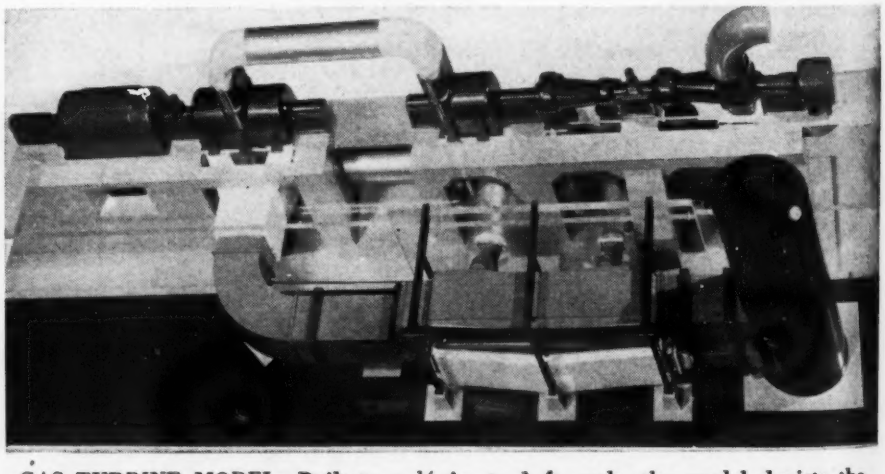
•

Model Gives Preview of Gas Turbine Appearance

Believed to be the first design actually proposed for power generation in the utility field, the illustrated scale model gas turbine shows how Allis-Chalmers engineers expect the unit to appear.

The model is of a 10,000-kw. unit, designed for operating at 1,300 deg. F., and is expected to have an efficiency of 31 percent, according to R. C. Allen, manager and chief engineer of the company's steam turbine department. The actual unit will occupy approximately 4,500 sq. ft. The model was built to a ½ in. to 1 ft. scale. It is built of wood, metal and plastic.

At the same time the company is proposing a second 10,000-kw. unit designed



GAS TURBINE MODEL—Built to a ½ in. to 1 ft. scale, the model depicts the appearance of a 10,000-kw., 1,300 deg. F. unit. Starting at extreme left (and continuing toward right) on the upper tier, the exciter, generator, low-pressure turbine, low-pressure combustion chamber, high-pressure turbine, high-pressure compressor, low-pressure compressor, and starting motor are shown; in the foreground on the lower level are the stack, regenerator and high-pressure combustion chamber

SUNSWITCH
LIGHT CONTROL

GIVES YOU LIGHT . . . WHEN NEEDED

The inconspicuous, rugged "SUNSWITCH" unit shown, automatically switches street lights "on" and "off" by means of a sensitive photo-electric cell operating entirely according to the foot-candle value of daylight . . . gives illumination always and only when needed.

Unit housed in extruded aluminum. Installation is simple: — a 30° twist makes a perfect electrical and weatherproof coupling.

SUNSWITCH, the first compact electronic light control, offers the most modern method of switching street lighting. Applicable to series or multiple circuits and individual installations. Vacuum tubes and other components operate at much below capacity — insuring unusual longevity and low maintenance costs. SUNSWITCH units are now available for testing on your own lighting systems.

SPECIFICATIONS - MODEL No. 8239

Operating voltage 105 to 125 volts, 50-60 cycles. (Also available for 210 to 250 volts: 50-60 cycles to special order.)
Power consumed approximately 10 watts.
Sensitivity from 1 to 10 foot-candles, as specified.
Operating load on contacts — 1800 watts 15 amps. non-inductive or incandescent light load.
Capacity for momentary inrush load current — 160 amperes.
Height complete unit 9¾".
Diameter 4⅛".
Weight complete with base and mounting bracket — 5¼ lbs.

RIPLEY Company, Inc.
Industrial Controls Division
NEW LITCHFIELD STREET, TORRINGTON, CONN.

OTHER APPLICATIONS
include outdoor advertising, airport beacons and runways, radio masts, hatcheries, greenhouses, etc.

to operate at 1,000 deg. F. and this unit is expected to have an efficiency between 15 and 20 percent.

•

Small Breakers, Switches Rise 13 Percent in Price

Knife and enclosed switches and small circuit breakers were granted temporary price increases averaging 13 percent above the 1941 quotations by an Office of Price Administration order issued last week.

Switches having 100-amp. capacity or less may be increased 15 percent, and those above 100 amp., 10 percent. Enclosed branch circuit cutouts, including the enclosing cabinet, may be advanced 15 percent. Prices of small air circuit breakers, panelboards and distribution boards, busways, busway plugs and connectors, busway fittings and busway trolley-type collecters may rise 10 percent.

The pricing agency states that these increases will hold until a cost survey is completed, but in no case will the increase granted be lower than 13 percent. Manufacturers who have been granted increases over 1941 prices will be allowed to take only the difference between the 13 percent and the previously adjusted price, the agency pointed out.

•

L. K. Braunston Organizes New Moldex Corporation

Louis K. Braunston, recently resigned vice-president and general manager of Miller Products Co., has organized his own company, Moldex Rubber & Plastics Corp., of which he is president, with executive offices at 1 East 57th St., New York, and branch offices in Akron, Kansas City and Los Angeles.

Associated with Mr. Braunston is A. A. Mayers as vice-president and George J. Wilson, plastics engineer.

Plants to serve the needs of the Moldex Co. and its customers are located in Akron, Ashtabula, and Bedford, Ohio; Newark, N. J.; Kansas City, Mo.; Buffalo, N. Y., and in New York City.

•

Forms Distribution Unit

Creation of a distribution department, to establish and direct RCA Victor's distribution policies and methods and to act in an advisory capacity on general sales policies, has been announced by Frank M. Folsom, executive vice-president in charge of the RCA Victor Division, Radio Corp. of America. Walter M. Norton, director of the education and training division, has been named director of this new department.

Electrical Apparatus Fires Viewed at Demonstration

Extinguishing electrical and industrial fires, as well as demonstrating the effectiveness of carbon dioxide equipment, were the main themes of the first demonstration held since the war at the enlarged proving grounds of Walter Kidde Co., Inc., Belleville, N. J. An audience of 500 utility, industrial and safety officials was present.

OUT IN 22 SECONDS—Oil fire on transformer case and platform was declared all out in 22 seconds

Among the demonstrations of major interest to the electrical industry were the ruptured transformer fire and a large building fire showing the effectiveness of various detecting systems and of extinguishing by total flooding.

In the transformer fire, insulating oil was allowed to leak from a damaged pipe, to cover the side of the transformer and to spill over the concrete platform and the ground. The oil was then ignited and allowed to burn 20 seconds before being attacked with a 75-lb. wheeled extinguisher. The illustration shows one of the company's experts extinguishing the fire in 22 seconds.

The building fire was set up to assimilate those which occur in transformer, bus and switching rooms. All doors and windows were open to provide circulation. The building was protected by a battery of carbon dioxide cylinders and three systems of valve actuation.

The six pans containing oil and the oil spilled on the floor were ignited. The rate-of-rise system operated the valves in 10 seconds, the fixed temperature electrical system in 16 seconds, and the quartz bulb link system in 20 seconds. At the same instant that the valves were opened, the mechanisms to close the windows and fire doors were caused to operate and thereby cut off all ventilation. Six seconds after the gas began flooding the room the fire was declared out by the viewers.

•

G.E. Five-Year Rural Plan Presented by G. E. Mullin

General Electric Co.'s five-year program for developing the rural market for electrical appliances and farm equipment, with an estimated $5,000,000,000 potential, was discussed recently by George E. Mullin, manager of the farm sales division of the company's appliance and merchandising department, Bridgeport, Conn.

Mr. Mullin told the farm marketing discussion group of the New York chapter of the American Marketing Association that research had revealed farm savings totaling $16,000,000,000, indicating average cash savings of $2,500 for each farm family, that might be turned to improvement.

Explaining that it was expected that 5,000,000 farms would be electrified by 1950, he said that General Electric wishes to increase its 800 dealers serving rural areas to 3,000. The program also provides for establishment of stores combining both appliances and farm production equipment, which he called a need in view of the fact that findings indicate that the average farm is 14 miles from town.

•

Electrical Manufacturers Report Increased Sales

Weston Electrical Instrument Corp.'s sales for the first quarter of 1946 were approximately $2.5 million, according to Caxton Brown, president. The anticipated volume for the full year is about 250 percent more than the pre-war average of $3.6 million, he stated.

Production has been hampered by material shortages, and until recently unfavorable price ceilings curtailed output of new products, Mr. Brown said. At present, however, about one-third of the new products and new models planned are in the tooling stage and should be on the market in a few months. Weston is consolidating operations by disposing of properties leased during the war. An engineering and administration building is being constructed at an estimated cost of $750,000.

Sales of Noma Electric Corp. and subsidiaries in 1946 will exceed $28 million, Henri Sadacca, president, told stockholders at the recent annual meeting. Sales for the first quarter of this year were disappointing, Mr. Sadacca stated, but

ROCKBESTOS A.V.C.

Cuts Maintenance Expense in Hot Electrical Circuits

ROCKBESTOS A.V.C. Lead Sheathed Power Cable
Made in 600, 1000, 2000, 3000 and 5000 volt ratings. Also with all types of armor finishes or covered with heat, flame and moisture resistant impregnated asbestos yarn braid.

Insures Operation of
Exhausters
Precipitators
Valve Controls
Ash Slush Pumps
Forced Draft Fans
Boiler Feed Pumps
Coal Grinding Mills

For those circuits that you can't keep far enough away from the baking heat of boilers, steam lines, hot ashes and rotting fumes . . . and for those that have the job of keeping essential equipment running regardless of severe operating conditions . . . specify Rockbestos A. V. C.

You won't have to worry about failure-creating heating and cooling cycles in ducts or conduit runs, or continuous high ambients, if you install these *permanently insulated* wires and cables. Their impregnated asbestos insulating walls are built to take heat and moisture without drying out, cracking or flowing . . . and they won't rot, swell or burn if attacked by fumes, oil, grease or flame.

The Rockbestos A. V. C. constructions illustrated and many others, including Switchboard Wires, Multi-Conductor Power Cables, Secondary Network and Fireproof Vault Cable, and Rockbestos All-Asbestos Wires and Cables, are described in our catalog. Send for one.

ROCKBESTOS PRODUCTS CORPORATION
146 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.
The Wire with Permanent Insulation
NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

ROCKBESTOS A.V.C. 600 VOLT MULTI-CONDUCTOR CABLE

This flexible cable is made in standard sizes AWG 12—19/#25 and AWG 9—19/#22 and also with special strandings in two to nineteen conductors. The individuals are insulated with impregnated felted asbestos and varnished cambric exactly like Rockbestos A. V. C. Motor Lead Cable and the Power Cable illustrated above, and are covered with color-coded cotton braid for easy circuit identification. The heavy asbestos yarn braid is standard but lead sheath, armor, or both can be supplied on special order.

125 permanently insulated wires, cables and cords have been developed by Rockbestos for trouble-free performance under severe operating conditions.

current volume is considerably improved. Business for the first three months totaled $3,319,000, whereas April shipments alone were $1,947,000 and May shipments were estimated at $2,100,000.

•

Wood For Storage Batteries Discussed at Meeting

War-time shortages of wood battery separators, which bottlenecked production of electric storage batteries, were relieved when the Forest Products Laboratory maintained at Madison, Wis., by the Forest Service, U. S. Department of Agriculture, showed how woods other than Port Orford white cedar could be made into satisfactory separators. This was disclosed by Dr. George J. Ritter of the Laboratory staff in a recent address before the cellulose division of the American Chemical Society on "Wood for Storage Batteries."

Research at this Laboratory made possible the use of noble fir, Alaska yellow cedar, and Douglas fir and at the same time developed a more economical process than that previously used for the Port Orford white cedar.

Wood used for separators must be chemically treated to remove various extractives, such as tannins, oils, resins, fats, waxes, and acetic acid. Besides removing extractives, chemical processing makes the separator porous enough to permit easy passage of the electrolyte solution and flexible enough to stand up well in service.

The chemical treatment used for pre-war separators functioned best with Port Orford white cedar, although some Douglas fir was used. War-time demands, however, exceeded the supply of this white cedar and put separator wood on the critical list.

The Laboratory process uses less chemical than was used in the pre-war process. Various chemicals and treatments were tested. A 1.6 percent sodium hydroxide solution was found suitable for both the Port Orford white cedar and three alternate woods. The separators are soaked in the solution long enough to remove the extractive material, after which they are placed in clear water at about boiling temperature and then transferred to cooling water.

After chemical treatment, the experimental woods were tested for electrical performance and for strength. Strength was determined by bending them around a mandrel and in a tensile-strength machine. These strength tests showed two other woods, redwood and bald cypress, which were satisfactory in electrical performance, to be somewhat weaker than the approved alternate woods.

FIELD REPORTS ON BUSINESS

A slightly better feeling is becoming apparent in the electrical trade. Load building by utilities in rural areas is more active, though shortages of line material are still a handicap. Interest in industrial electric heating is growing steadily.

NEW ENGLAND

A slightly better feeling was apparent in the electrical trade as June ended, owing to the receipt of merchandise in varied lines by distributors which in typical cases compared well with the last pre-war year in the northeast, though it did not greatly exceed 1941. Encouragement in the sales outlook was evident at the Boston convention of oil burner manufacturers last week, recent labor troubles in the coal field having stimulated interest in liquid fuel applications. Vigorous efforts are being made to produce fractional horsepower motors for these devices, refrigerators and vacuum cleaners this summer and fall. Cool weather in June was a deterrent to electric fan demand in this area, which seldom continues high activity after July 4. Electric blankets are being produced in good volume.

Expansion of radio broadcasting facilities is noted. Providence Journal seeks permission to establish an FM broadcasting station and has placed conditional orders with General Electric for a 10-kw. transmitter and with Graybar Electric for studio equipment. Estimated total cost including studio soundproofed by Johns-Manville, $439,555. Colonial Broadcasting Co. and Cherry & Webb, Providence, also desire to erect new facilities. New England Telephone will soon complete facilities between Nantucket Island and the Cape Cod area, including eight microwave radio circuits, supplementing a 30-year old, 12-circuit submarine cable.

Load building by utility sales representatives in rural areas is more active, though shortages of line material are still a great handicap to extensions eagerly desired by both supply systems and farmers. Distribution systems have been well restored after recent severe storms. Interest in industrial electric heating is growing steadily, and the New England Power System's new laboratory at Worcester is being developed as rapidly as materials permit. Some aerial survey work is being done in this region of the East in relation to prospective additions to utility transmission facilities within the next year or two.

CHICAGO

Electrical wholesaling activity here is crippled by material shortages which show no signs of abating. Wiring is impossible to obtain; conduit, next to impossible. Several wiring manufacturers are reportedly ceasing operations. Because of the situation in electrical supplies, the settlement of the brick manufacturing strike in this area has not been reflected in increased construction. Another factor has been lumber shortage.

Wholesalers complain of a price squeeze on appliances as a result of OPA policies. This group has had to absorb several advances in its costs without being able to pass them on. Such has not been the case, however, with electrical construction and installation materials, where retail prices have advanced proportionately.

The uneven supply situation caused by sporadic strikes has created a serious unbalanced inventory condition, as evidenced by the warning to radio manufacturers here issued against building up of excessive stockpiles of radio tubes, whose parts are not as scarce as other electrical materials. Some sections of the radio parts industry are already producing at pre-war levels, while acute shortages exist in other phases of radio, such as wood cabinets.

PACIFIC COAST

Because of material shortages and stringent government requirements to be met before material can be allocated via wholesaler and dealer channels, very little new electrical construction is reported for resorts and summer hotels though it is predicted that this season's overcrowding of the comparatively few places operating will produce a sizable volume next year. Urban hotels planned include a $750,000 structure for Boise; $1,250,000 hotels in Las Vegas and San Jose; a possible 1,600-room Statler Hotel in Los Angeles; $1,500,000 expansion for existing structures in Long Beach and Beverly Hills; amount averaging $500,000 for many hotels in such interior cities as Phoenix and Elko. Much electrical work, such as increased wiring capacities, elaborate lighting and intricate call and signal systems is indicated by the $45,000,000 modernization program of the Los Angeles hotel industry.

Industrial developments include a $2,500,000 wallboard plant planned by U. S. Gypsum Co. for Plaster City, Imperial County, Calif.; a $5,000,000 sheet steel mill for Seidelhuber Iron and Bronze Works of Seattle. CPA approval of $1,677,000 for General Mills cereal plant in Los Angeles and War Assets acceptance of U. S. Steel's $45,000,000 offer for its Geneva (Utah) steel plant.

NEW YORK

American business, exclusive of agriculture, anticipates spending about $2.4 billion for new plant and equipment during the second quarter of 1946, according to the quarterly survey made public jointly by the Securities and Exchange Commission and the Department of Commerce. This may be compared with $2.1 billion in both the first quarter of 1946 and the last quarter of 1945. Of this sum, the electric and gas utilities account for $220,000,000.

The spotlight of the new-issue market was focused last week on the public utility field when eleven syndicates put in bids for five issues of securities, ranging all the way from $50,000,000 of Wisconsin Electric Power bonds to 204,153 shares of Ohio Edison Co. common stock.

Civil engineering construction volume in continental United States totaled $128,605,000 for the week ending June 27 as reported to *Engineering News-Record*. This volume is 22 percent above the previous week and 176 percent above the corresponding week of last year. Total engineering construction for the 26-week period of 1946 records a cumulative total of $2,632,186,000, 200 percent above the total for the similar period of 1945.

★★★★4 OF THE 1008 METROPOLITAN ELECTRICAL UNITS *in* RADIO CITY

COMPLETE ELECTRICAL CONTROL by

At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards
Circuit Breaker Switchboards
Dead Front Switchboards
Battery Charging Switchboards
Motor Control Switchboards
Explosion-proof Switchboards
Laboratory and Test Switchboards
Control Switchboards
Generator and Distribution Switchboards

ESTABLISHED 1892 METROPOLITAN TRADE MARK ELECTRIC MANUFACTURING COMPANY

ELECTRIC LIGHTING AND POWER
DISTRIBUTION EQUIPMENT
LONG ISLAND CITY 5, NEW YORK

MAILING LISTS THAT WORK...

McGraw-Hill Industrial Mailing Lists are a direct route to today's purchase-controlling executives and technicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

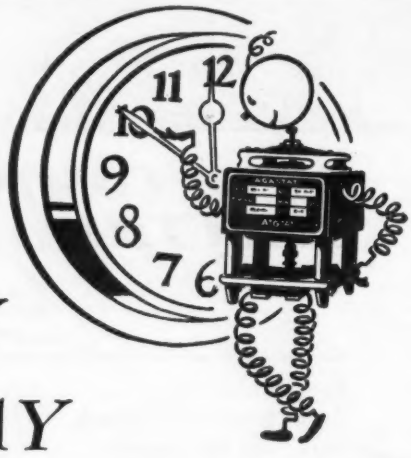
Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

McGraw-Hill Publishing Co., Inc.

DIRECT MAIL DIVISION

330 West 42nd Street New York, 18, N. Y.

TIME DELAY RELAY



● Timing control for Power machinery...Motors...Generators ...Radio and Electronic Circuits...Industrial process timing... Radio tube preheating...Signalling circuits—and many other applications. Time delay adjustable—a fraction of a second to several minutes.

Write for information and literature...No obligation

AGASTAT

Electro-Pneumatic *TIME DELAY RELAY*

ELIZABETH A·G·A NEW JERSEY

AMERICAN GAS ACCUMULATOR COMPANY

SALES OPPORTUNITIES

KANSAS—Kansas City Public Service Co., Kansas City, Mo., operating local traction system, plans new power substation for feeder service on North 10th St., Kansas City, Kan., one-story, 38 by 44 ft. Proposed to begin work at once.

IOWA—Town Council, New Hampton, will receive bids until July 24 for two diesel engine-generator units, each with rating not less than 1,000 hp. or more than 1,200 hp., with completed auxiliary equipment, for installation in municipal power plant. Jesse B. Harris Co., Wesley Temple Bldg., Minneapolis, Minn., is consulting engineer.

VIRGINIA—West Virginia Pulp & Paper Co., Covington, plans expansion in local mill, comprising several additional buildings and installation of machinery and electrical equipment for considerable increased capacity. Cost reported close to $1,000,000. Work is scheduled to begin soon. Main offices are at 230 Park Ave., New York, N. Y.

CALIFORNIA—Bureau of Power and Light, Los Angeles, will award contract soon and begin erection of superstructure for addition to Harbor steam-electric generating station, Wilmington, to be known as Unit No. 2, estimated to cost approximately $500,000, exclusive of equipment.

OREGON—Bonneville Power Administration, Portland, is reported planning another call for bids for construction of new control house at power substation at Tillamook. No bids were received on earlier call for work.

DISTRICT OF COLUMBIA—Board of District Commissioners, District Building, Washington, plans installation of new motor-driven pumping machinery, controls and accessory equipment in connection with modernization and expansion in water system. Entire project estimated to cost about $19,500,000, and will be carried out over number of months. Financing program in initial amount of $10,000,000, is being arranged.

MINNESOTA—Otter Tail Power Co., Fergus Falls, is considering new generating station at Crookston, comprising a hydroelectric power development and steam-electric standby installation, similar to present generating plant at Hoot Lake. Plans are maturing for proposed expansion in latter station, including new multi-story addition and installation of generating units (for which contract has been let to Allis-Chalmers Mfg. Co., Milwaukee, Wis.), and auxiliary equipment. Extensions will be made in transmission lines. CPA, federal agency, permission has been granted. Completion is scheduled late in 1947. Cost estimated close to $1,000,000

ILLINOIS—Ditto, Inc., 2243 West Harrison St., Chicago, duplicating machines and parts, plans new plant at Pratt Ave. and McCormick Rd., Lincolnwood, near Chicago, one-story, totaling close to 200,000 sq. ft. floor space, with machinery and electrical equipment for large capacity. Cost reported close to $1,000,000. Battey & Childs, 231 North LaSalle St., Chicago, are architects.

MISSOURI—At recent special election at Carrollton, bond issue of $100,000 was au-

thorized for proposed expansion and improvements in municipal power plant, including installation of new diesel engine-generator unit and auxiliary equipment. Bids will be asked soon. E. E. Barton, superintendent, Water & Light Department, in charge.

ARKANSAS — Arkansas - Missouri Power Corp., Blytheville, plans new transmission line from point on Greene-Craighead County line to Blytheville, by way of Paragould and Rector, totaling about 61 miles. Fund of $500,000 is being arranged through sale of bond issue for this and other line extensions.

CALIFORNIA—Pacific Gas & Electric Co., San Francisco, plans extensions in Ames and Monte Vista power substations, with installation of transformers, switchgear and auxiliary equipment for increased capacity. Work will begin soon.

WYOMING—Bureau of Reclamation, Cody, will receive bids until July 19 for construction of Heart Mountain hydroelectric generating station, near Cody, including concrete building, installation of radial gates, radial gate hoists, bulkhead gates, penstock, 46,500 lin.ft. electrical non-metallic conduit in power plant, switchyard and duct banks, etc., Shoshone Project. (Specifications 1385).

TEXAS—Ruberoid Co., 500 Fifth Ave., New York, N. Y., prepared roofing, etc., plans new plant at West Dallas, comprising a main one-story processing and production building, and several auxiliary structures, with machinery and electrical equipment for large output. A power house is planned and power substation for central station service. Cost reported about $1,000,000.

OHIO—New York, Chicago & St. Louis Railroad Co., Terminal Tower Building, Cleveland, has approved plans for new multi-story power plant at locomotive and car repair shops, Bellevue, about 45 by 80 ft., and will begin work at early date.

OHIO—International Milling Co., McKnight Building, Minneapolis, Minn., plans new flour mill on Whiskey Island, Cleveland. It will comprise a large one and multi-story building for processing and production, with machinery and electrical equipment for capacity of 2,000 bbl. per day. Also grain elevator with capacity of 1,000,000 bu., and auxiliary structures. Boiler house will be built, with power substation. Entire project reported to cost approximately $2,500,000. Proposed to begin work soon.

IOWA—Board of Trustees, Municipal Electric Plant, Brooklyn, will receive bids until August 7 for one diesel engine-generator unit, 300 to 375-kw. rating, with exciter and auxiliary equipment for installation in power station, where expansion will be carried out, as per plans and specifications on file. C. C. Ecklund is chairman.

KANSAS—City Council, City Hall, Olathe, plans early call for bids for pumping units, about 350 gal. per min. rating, with motors, controls and auxiliaries, in connection with extensions in water system. E. T. Archer & Co., Railway Exchange Building, Kansas City, Mo., are consulting engineers.

TEXAS—Deep East Texas Electric Cooperative, Inc., San Augustine, has engaged Baker Engineering Co., Moore Building, San Antonio, consulting engineer, to make surveys and plans for extensions in primary and secondary lines in parts of San Augustine and neighboring counties. Bids are scheduled to be asked soon.

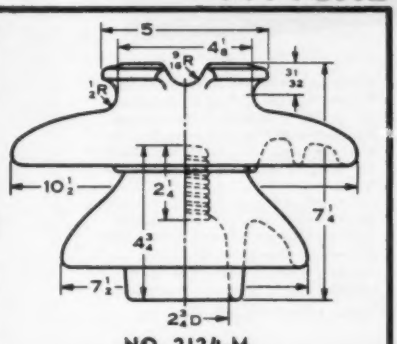
THOMAS

Porcelain Insulators and Line Hardware

Here are a few items from our complete line of Porcelain Insulators and Line Hardware selected by Engineers for 33 Kv. construction.

For complete engineering details and a copy of our latest Catalog No. 40—mail the coupon below.

TYPICAL DESIGNS



NO. 2124-M

45 Kv. Rating

Dry Flashover	125 Kv.
Wet Flashover	85 Kv.
Rec. Pin Height	8 In.
Std. Pkg. Crate	6

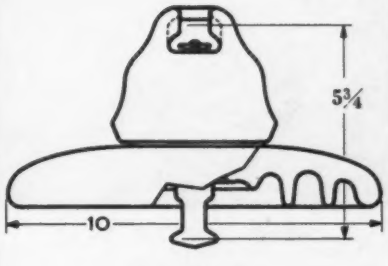
This insulator generally used on 33 Kv. can also be furnished in one-piece design (No. 1924). Mechanical, thermal and electrical characteristics are well balanced insuring long life in service.

NO. 9716 SERIES

Tapered Body Style for Wood or Metal Arm

Height Above Arm	6 to 13 In.
Below Arm	1¾ or 7 In.

Pins are a solid forging of special high carbon steel. Tapered design allows uniform strength in all directions with full strength carried to top.

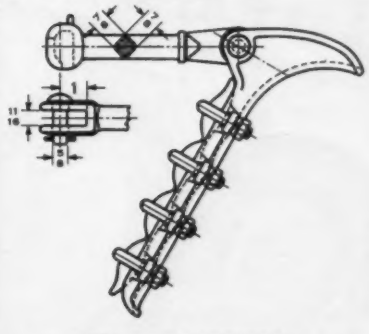


NO. 21243

15,000 Lb. Min. Combined M. & E. Rating

Dry Flashover	80 Kv.
Wet Flashover	50 Kv.
Leakage Distance	11½ In.
Std. Pkg. Crate	6

This design is offered in a wide range of spacings in both Ball-Socket and Clevis types which fulfill all strain insulator requirements.



NO. 5000 SERIES

S. A. E. 1035 Copper Bearing Steel, Galvanized

Min. Cable Sizes	.187 to .82 In.
Max. Cable Sizes	.55 to 1.28 In.
Ultimate Strengths,	25,000 - 35,000 Lbs.

Offered for all sizes of A. C. S. R., copper and composite conductors, light in weight but with mechanical and slip strength adequate for the most severe service.

THE R. THOMAS & SONS CO.
Lisbon, Ohio

Please send me your Catalog No. 40 illustrating Porcelain Insulators and Line Hardware for Distribution Lines.

Name ..... Title .....

Address .....

City and State .....

THE R. THOMAS & SONS CO.
LISBON, OHIO
New York · Boston · Chicago

NEW INSTRUMENT FOR 60 CYCLE CALIBRATION

The Browning GA-10 Frequency Meter Calibrator and PF-10 Power Supply

Precise checking of switchboard-type, direct-reading and 60 cycle frequency meters, and the measuring of line voltage frequency from 56 to 64 cycles, is readily accomplished with the Browning GA-10 Frequency Meter Calibrator. It is also especially useful in setting filters requiring accurate adjustment.

Featuring complete electronic voltage regulation, and built-in crystal standard for checking various points of the calibration, the Browning GA-10 has an accuracy of ± .05% over its entire range. The Calibrator and Power Supply are packaged in separate steel carrying cases for ease of portability.

For adjusting or checking equipment with different frequencies, such as sharply peaked filters, the Browning GA-10 is available on special order to cover a narrow range of any audio frequencies.

WRITE FOR DESCRIPTIVE LITERATURE

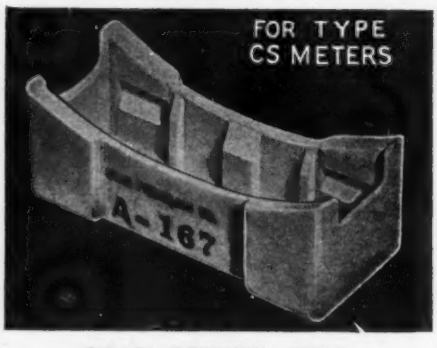
BROWNING LABORATORIES, INC. WINCHESTER, MASS.

durable!

Galvanized, drop-forged steel!

Mfd. by American Hoist & Derrick Co., St. Paul.

CROSBY CLIPS



STAR METER SEAL

Eliminates meter tampering. Cannot be removed without multilating. SEND FOR SAMPLE.

STAR PORCELAIN CO.

51 Muirhead Ave. Trenton, N. J.

STAR PORCELAIN COMPANY, LTD.
49 MAIN ST. TORONTO 14, ONT.

BUY

all the Bonds you can

and

KEEP

all the Bonds you buy

Recent Rate Changes

CENTRAL POWER & LIGHT CO., Corpus Christi, Tex., has announced electric rate reductions which will save its customers approximately $1,000,000 a year. Lon C. Hill, president of the company, said that the new lower rates would become effective this month and would apply to most customers, including residential, commercial, rural and many industrial users. At the same time, he asserted, rate schedules are being simplified and some types of rates eliminated entirely. Minimum charges applicable to residential customers have been either reduced or adjusted to include more kilowatt-hours. This general rate reduction, Mr. Hill pointed out, follows an earlier reduction this year of rates to municipalities for water pumping, sewer pumping, street lighting and miscellaneous purposes. The cost of these operations to cities served by the company will be reduced about $68,000 annually through these lower rates.

GATINEAU POWER CO., has made a reduction in its electric rate schedule in Hull, Que., effective July 1. The rates put into effect are: 1.8 cents a kilowatt-hour for the first 60 kw.-hr.; 0.9 cents per kilowatt-hour for the next 60 kw.-hr., and 0.45 cents a kilowatt-hour for any additional.

SOUTHERN CALIFORNIA EDISON CO., INC., reduced on June 1 its domestic, commercial and agricultural rates approximately $1,083,000, through recent authorization by the State Railroad Commission. The reductions will save domestic customers $537,000, commercial users $482,000, and agricultural users of electricity $64,000. Simultaneously, the company prepared to increase industrial rates on its contracts containing fuel oil escalator clauses that will adjust to a 40 percent increase since 1943 in fuel oil prices. About $273,000 will be realized during the coming year from the rate increase, in contrast to added fuel oil costs over the three-year period of approximately $850,000. The adjustable rate schedules provide for an increase of 0.15 mills per kilowatt-hour for each rise in fuel oil price above 85 cents per bbl.

NORTHERN STATES POWER CO. has put into effect a new general service electric rate which will save the city of St. Paul an estimated $19,000 a year on municipal electric bills, according to an announcement by Commissioner William Parranto. The new rate has been negotiated by the public utilities department and the Northern States Power Co. and applies only to electricity bought by the city for its own use. The new rate is 2½ cents flat per kilowatt-hour, compared with a rate of 4 cents per kilowatt-hour for municipal lighting and 3 cents per kilowatt-hour for power purposes, which rates have been in force for many years. Commissioner Parranto told City Council the new combined rate would permit elimination of separate services and meters for various uses of electricity in any municipal building, and in addition would result in savings to the various city departments.

•

Makes Stock Offering

Public offering of 49,500 shares of Plastic Wire & Cable Corp. no-par common stock was recently made at $6 a share by an underwriting group headed by Putnam & Co., Hartford. Proceeds from the sale will be added to the company's working capital and will be available for general corporate purposes.

SEYMOUR SMITH
TELEPHONE PRUNERS

CUT FASTER, COVER MORE GROUND-Keen "Center-Cut" blade slices between two strong side supports. Branch is firmly gripped, quickly cut. Ask for prices.

SEYMOUR SMITH & SON, Inc.
901B Main St., Oakville, Conn.

REA Allotments Granted to 13 Co-ops

Rural Electrification Administration has recently approved loan allotments totaling $9,686,000 to 13 cooperatives in eight states. The details of the loans, to be used for construction of rural electric facilities, are as follows:

KANSAS—Pioneer Cooperative Assn., Inc., Ulysses, $1,130,000; Sugar Valley Electric Cooperative Assn., Inc., Mound City, $635,000.

NEBRASKA—Howard County Rural Public Power District, St. Paul, $540,000.

NORTH CAROLINA—Carteret-Craven Electric Membership Corp., Beaufort, $25,000.

NORTH DAKOTA—Slope Electric Cooperative, Inc., New England, $500,000; Capital Electric Cooperative, Inc., Bismarck, $425,000.

SOUTH DAKOTA — Tri-County Electric Assn., Inc., Plankinton, $550,000; Spink Electric Assn., Inc., Redfield, $245,000.

TEXAS—Brazos River Transmission Electric Cooperative, Inc., Waco, $5,200,000.

UTAH—Garkane Power Assn., Inc., Richfield, $125,000.

VIRGINIA—Prince William Electric Cooperative, Manassas, $296,000; Powhatan Refrigeration Cooperative, Inc., Clayville, $11,000; Free State Refrigeration Cooperative, Inc., Kinbridge, $4,000.

•

Acme Electric Incorporates Under Laws of N. Y. State

Announcement has been made that the Acme Electric & Manufacturing Co., Cuba, N. Y., has been incorporated in the State of New York under the name of the Acme Electric Corp. No change in ownership is involved in the change of name. This action was taken by Acme directors in view of the fact that the company's principal factories are located in New York State, according to C. H. Bunch, president.

The Acme Electric & Manufacturing Co., an Ohio corporation, was founded 29 years ago in Cleveland, Ohio, by Mr. Bunch and G. R. Hillstrom, and the assets and liabilities of this company have been transferred to the Acme Electric Corp.

•

Wilms, Weaver Dissolves

Wilms, Weaver & Co., Detroit, Mich., has been dissolved by mutual consent. Mr. Weaver will continue in the same general line as that followed by Wilms, Weaver & Co., under the firm name of Charles Weaver & Co., handling steam turbine-generators and general power plant equipment, diesel engines, etc., with headquarters in Penobscot Building, Detroit. Mr. Wilms will operate as Walter H. Wilms & Co., specializing in general construction and marine equipment, with offices in the Guardian Building, Detroit.

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

SALT TABLETS and DISPENSERS

Maintained close to the drinking water supply they provide a convenient and sanitary means of supplying your workers with Salt Tablets during the hot Summer months.

Replaces the salt lost thru perspiration, prevents heat sickness and sustains normal energy. Time proven and recognized by all industries.

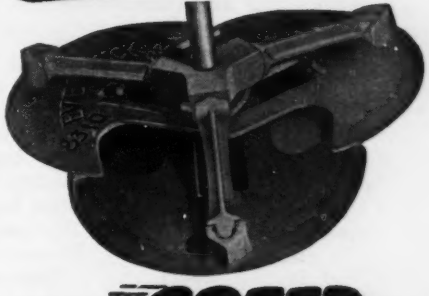
PRACTICAL FOR INDOOR and OUTDOOR USE

Furnished complete with mounting bracket for wall installation, on tool trucks, trailers and other locations.

WRITE FOR BULLETIN EW-76

IPCO
Safety Equipment for all Industries
INDUSTRIAL PRODUCTS COMPANY
2808 N. FOURTH STREET • PHILADELPHIA 33, PA.

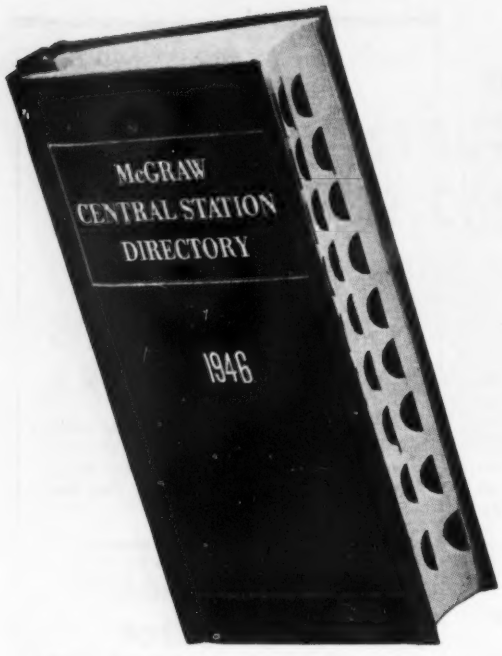
EVERSTICK ANCHORS...



FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA



Presenting the 1946 edition of the

McGRAW CENTRAL STATION DIRECTORY

This latest, most accurate coverage of postwar changes in electric utility operations and personnel is published for those who work in or sell to the electrical utility industry.

The 1946 edition of the McGraw Central Station Directory, now ready, lists in one compact volume every discoverable change in the electric utility industry during the past 12 months. Changes in personnel and operations up to April 1, 1946 and other exclusive data on organization, areas served, generation and distribution equipment are included for each of 4,000-odd utility plants in the U. S., Canada and U. S. possessions.

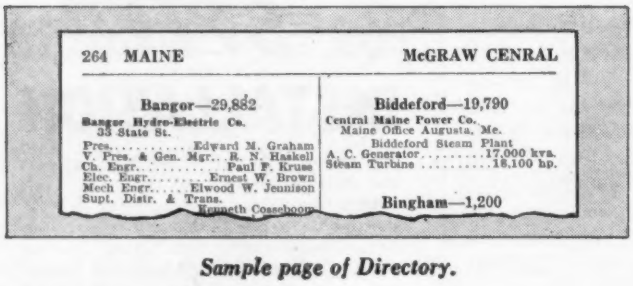
Facts Presented:

1. Names and addresses of private and municipally operated electric light and power companies in the U. S., Canada, and U. S. possessions; also government-controlled projects.

2. Names and addresses of affiliated, holding, controlling or managing and service companies with complete lists of properties controlled or managed by each, and including names and addresses of principal officials.

3. Names and addresses of officials and chief operating men for all operating companies, including:

- Presidents
- Vice Presidents
- General Managers
- Superintendents of Distribution
- Mechanical Engineers
- Commercial or New Business Managers
- Superintendents of Transmission
- Plant Superintendents
- General Superintendents
- Purchasing Agents
- Division or District Superintendents
- Chief Engineers
- Electrical Engineers
- Plant Engineers
- Merchandising Managers
- Division or District Managers


264 MAINE — McGRAW CENRAL

Bangor—29,882
Bangor Hydro-Electric Co.
33 State St.
Pres. ..... Edward M. Graham
V. Pres. & Gen. Mgr.. R. N. Haskell
Ch. Engr. ..... Paul F. Kruse
Elec. Engr. ..... Ernest W. Brown
Mech Engr. ..... Elwood W. Jennison
Supt. Distr. & Trans. ..... Kenneth Cossboom

Biddeford—19,790
Central Maine Power Co.
Maine Office Augusta, Me.
Biddeford Steam Plant
A. C. Generator ..... 17,000 kvs.
Steam Turbine ..... 18,100 hp.

Bingham—1,200

Sample page of Directory.

REA Co-ops Listed:

REA co-operatives have been listed separately in the back of the Directory. This list includes new co-operatives formed during the past year.

Use by Utilities:

The directory is used by hundreds of utility executives who wish to know about:

1. The organization of other utilities, especially those in their own or adjoining areas.
2. Movements of officials from company to company.
3. Discernible trends in expansions of operations of other utilities.

Use by Manufacturers:

Manufacturers of electrical generating, transmission and distribution equipment, and manufacturers of general equipment and supplies, all serving the vast utility industry, make constant use of the directory for

1. Names and addresses of executive, supervising, managing and engineering officials.
2. Determining electrical characteristics of plant, equipment and lines now in use.
3. Knowledge of scope of operations: generating capacity, towns and number of meters served, etc.
4. For each operating company, the following information is presented:

- Company total and plant individual generating capacity in kva. or kw.
- Kind of prime mover and capacity in hp.
- Amount of power purchased in kw hrs.
- Type of current distributed, No. of wires, phase, voltage and cycle.
- No. of meters served.
- Location of power plants.
- Complete list of towns (of 500 population or over) served.
- A complete alphabetical index of companies listed.

Edition Limited:

Shortage of paper and binding facilities necessitates limiting the 1946 edition. Orders will be filled in order of receipt. The Directory is sturdily bound in flexible blue Fabrikoid, fully thumb-indexed, size—4½" x 8½". Price $25.00 per copy. 10% discount on 5 or more copies. For intelligent, productive planning and selling, a copy of the 1946 edition of the McGraw Central Station Directory should be in the hands of every executive responsible for such plans.

Send orders to

Catalog & Directory Division
McGraw-Hill Publishing Company
330 West 42nd Street, New York 18, N. Y.

TEST INSULATION
THE MODERN WAY

...WITH A

MEGOHMER

NEW NON-CRANKING TYPES

No more tiresome cranking of a hand-driven generator. Steady test potential of 500 volts D. C. instantly available at turn of switch. Direct readings of insulation resistances without calculations. Two types, Model B-5 and C-2. Ranges 0-200 megohms, and 0-100/1000 megohms with 1, 2 or 3 additional ohm scales in same instrument. *Write for Bulletin No. 435-445.*

HERMAN H. Sticht COMPANY, INC.
21 PARK PLACE NEW YORK, N. Y.

CABLE-SPLICERS' WIPING CLOTHS

IMPROVED PATTERNS OF GREATER UTILITY Formed-flexible Finishing Cloths. Catch Cloths. Crotch Cloths. New Type Cloth for Vertical Joints.

Send for literature and prices.

GEO. E. WILLIAMS, Mfr.
3035 Aldrich Ave. So.
Minneapolis, 8, Minn.

MARK ALL LINES AND TRANSPOSITIONS NOW

Cut down on repair costs by marking with Premax Metal Letters, Figures and Tags. They'll last as long as the pole. Send for details.

Premax Products
Division Chisholm-Ryder Co., Inc.
4606 Highland Ave., Niagara Falls, N. Y.

BOOK REVIEWS

X-rays in Practice. By W. T. Sproull. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 615 pages, illustrated. Price $6.

The author is a General Motors research physicist and, while giving the book the format of a college text with problems at the end of each chapter, he has nevertheless incorporated working information of timely pertinence to industrial electrical engineers confronted with radiography. Well over half the book is devoted to such matters of moment in industrial research as the x-ray equipment used, its protection, the technique of measurement, industrial radiography, crystallography, metallography and stress and strain determinations. The appendix carries comprehensive data about spectral lines, excitation potentials, absorption coefficients, atomics and crystallography.

Electronics in Industry. By George M. Chute. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 461 pages, illustrated. Price $5.

Specifically written for the industrial user of electronic devices rather than the electronic designer, the chapters aim to explain the circuit arrangements and functioning of a wide variety of applications. Among these are time-delay, light and heat relays, ignitrons, welding and motor control, voltage regulators, dimmers, rectifiers, recorders, register controls, Thy-mo-trol, etc. Before these are taken up, however, the author discusses in simple language how the pertinent types of tubes work and then progressively shows how they are incorporated in elemental circuits to achieve the basic functions needed for the more complex circuits that comprise the objective of the book.

•

Manufacturers Issue Earnings Reports

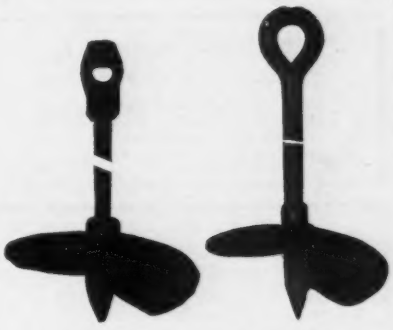
Among the electrical manufacturing companies which have recently issued earnings reports are the following:

ROME CABLE—For fiscal year ended March 31, 1946, net income $398,973, or $2.10 a share; for previous year, net income $486,653, or $2.56 a share.

SYLVANIA ELECTRIC PRODUCTS—Including Colonial Radio, total sales in 1945 reached new high—$126,792,723, compared with $100,398,043 in 1944. Consolidated net income for 1945, after provision for renegotiation of 1945 war business, all charges for state and Federal taxes and after provision for post-war adjustments and other contingencies, totaled $2,136,279, equivalent to $2.05 per share on 1,005,000 shares of common stock outstanding, after preferred dividends. This compares with $2,053,235 or $2.04 a share in 1944 when there was no preferred stock outstanding.

NOMA ELECTRIC—Including subsidiaries, net earnings for 1945 were $330,499, compared with $296,405 in 1944. Consolidated sales, $13,386,000 for 1945, against $8,580,000 in 1944.

BLAW-KNOX—March quarter, net profit, $28,936, equal to 2 cents a share on 1,334,458 capital shares, after a tax credit of $235,000 computed at rate of 38 percent and also after a transfer of $450,000 from reserves provided from income of prior years for war and post-war adjustments. Net profit for similar period last year was $738,154, or 55 cents a share.

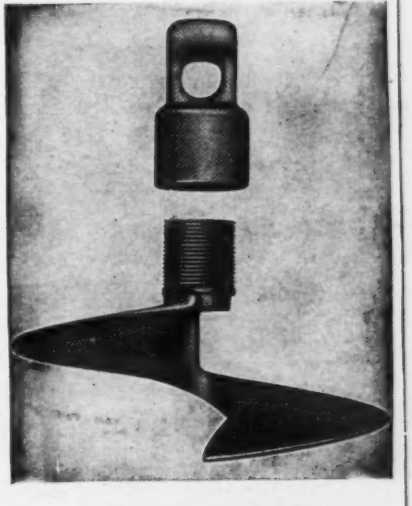


Matthews Scrulix Anchors

shown above were first put on the market in 1900. The one on the left is put down with a wrench. The one on the right is screwed down by putting a bar through the eye. The one shown at the bottom of this column is for use in swampy places and is put down with standard 1½ or 2-inch pipe.

Over 3,000,000 Matthews Scrulix Anchors have been sold and thousands of them are purchased every year. This type of anchor is ideal for use in dry loose sand, loamy ground; under shallow stands of water; on beaches and in swamps. They are made in sizes ranging from 4 inches in diameter to 12 inches. You will find that the 4-inch size will help reduce costs on those cheap rural lines. They will save you money over any anchor that requires the digging and filling of holes.

Write for Bulletin.



W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

PROFESSIONAL SERVICES

Associated Engineers, Inc.

Joseph C. Lewis, President

Management Consultants
Engineering . . Architecture - - Accounting
Organization - - Methods - - Costs.

230 E. Berry St., Fort Wayne 2, Ind.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

CHAS. T. MAIN, INC.

Engineers

Boston, Mass.

Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

FORD, BACON & DAVIS

ENGINEERS

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Philadelphia • Chicago • Los Angeles

J. H. MANNING & COMPANY

ENGINEERING SERVICES

120 Broadway, New York

BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

PAUL E. GERST & CO.

CONSULTING ENGINEERS

Specialists in
Electrical Product Design
El. Machinery, Apparatus & Applications
El. Appliances, Hi-Frequency Apparatus
Electronics, Radio Communications.

205 W. Wacker Dr. Chicago 6, Ill.

DANIEL W. MEAD
F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

E. J. CHENEY AND CO.

ENGINEERS AND CONSULTANTS

Economic and Business Surveys
Valuations and Reports
Rate and Rate Case Analyses

61 Broadway New York

GILBERT ASSOCIATES, Inc.

Engineers and Consultants

DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES

Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory

61 Broadway, New York — Reading Pa. — 17 & Sansom, Phila., Pa.
1417 K St. N.W. Washington, D. C.

ARTHUR L. MULLERGREN

Engineering-Management

Public Utilities—Natural Gas

Kansas City, Mo.

HUGH L. COOPER & CO. INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

350 Fifth Avenue New York 1, N. Y.

RAYBURN M. HAMILTON

Professional Engineer

711 Scanlon Bldg. Houston, Texas

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION

Consulting Engineers
Design Operations

Steam—Hydraulic—Gas

231 S. La Salle St. Chicago 4, Ill.

DAY & ZIMMERMANN, Inc.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK — PHILADELPHIA Packard Building — CHICAGO

FREDERIC R. HARRIS, INC.

ENGINEERS CONSTRUCTORS

MANAGEMENT
NEW YORK

Knoxville Houston San Francisco

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer

102 Maiden Lane New York

DOBLE ENGINEERING COMPANY

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications.

Office and Laboratory: Medford Hillside, Boston, Mass.

Branch Office: 20 N. Wacker Dr. Chicago, Ill.

HENKELS & McCOY

(Electric & Telephone Line Construction Co.)

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

SANDERSON & PORTER

ENGINEERS

AND

CONSTRUCTORS

Ebasco Services Incorporated

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

ELECTRICAL TESTING LABORATORIES INC.

Specializing in
TECHNICAL SERVICES
to those intent upon good quality

2 East End Avenue at 79th St., New York 21, N.Y.

WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases
Noroton, Connecticut

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

H. F. FERGUSON

Consulting Electrical Engineer

Expert advice on location and purchase of right of way.
Industrial plant layouts & surveys. Rate comparisons.

288 Alameda Avenue Youngstown, Ohio

LUCAS & LUICK

ENGINEERS

DESIGN, CONSTRUCTION SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

WHITMAN, REQUARDT AND ASSOCIATES

ENGINEERS — CONSULTANTS
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plans—Supervision—Appraisals

1304 St. Paul Street Baltimore 2, Md.